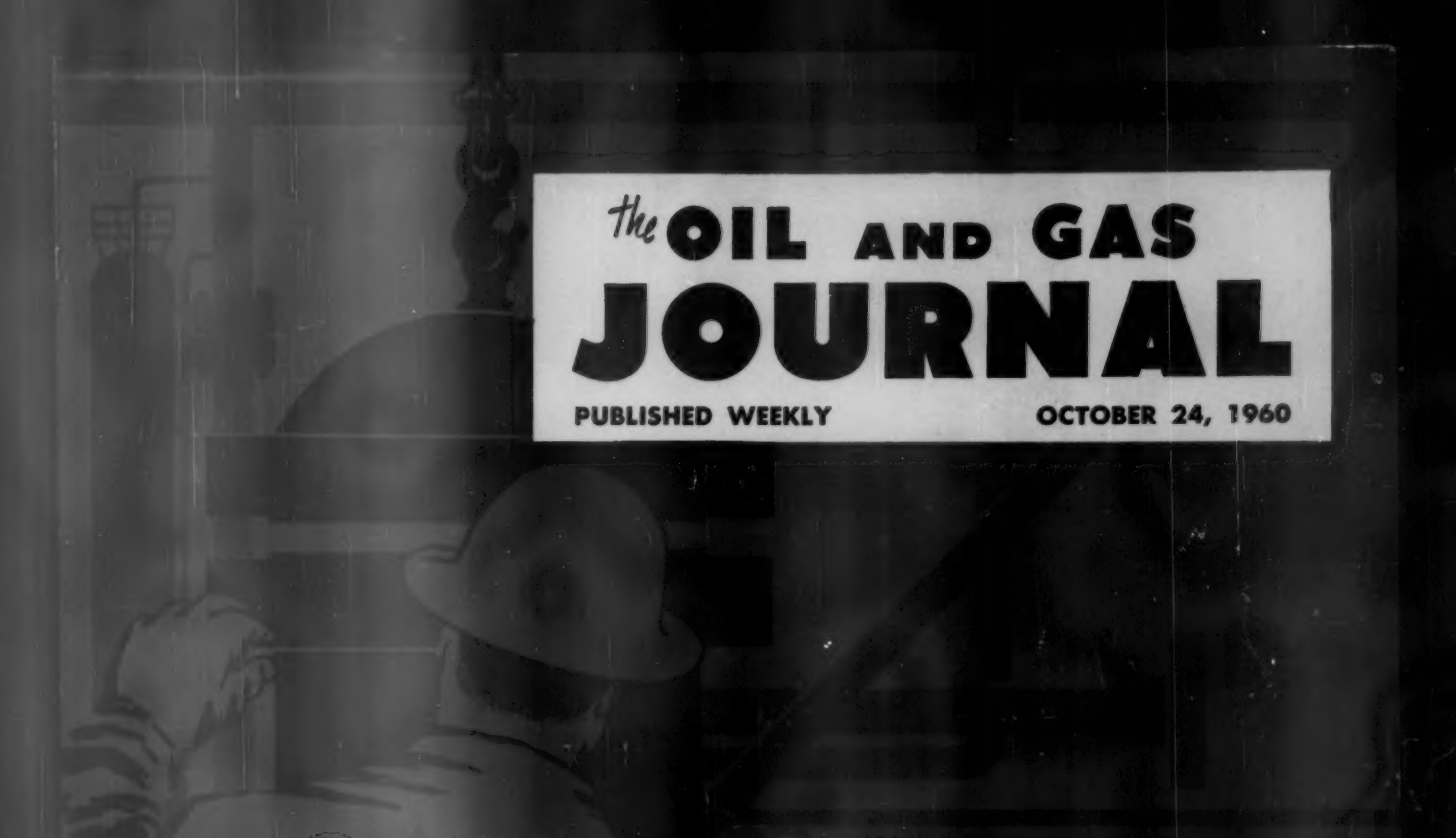
the OIL AND GAS JOURNAL
PUBLISHED WEEKLY OCTOBER 24, 1960



Refinery Maintenance Comes of Age

p.85

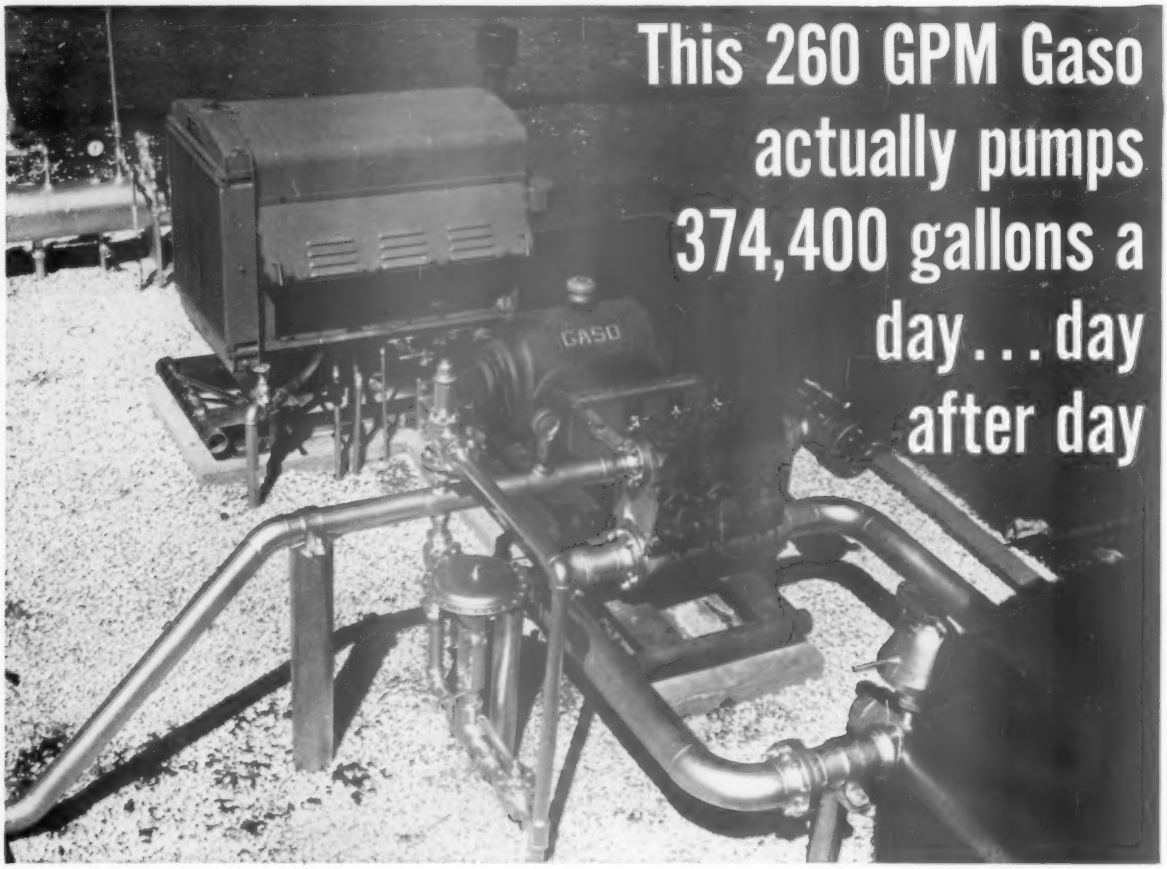
5 articles tell how to approach this important problem

Arabs push world-wide rationing ▸ 59

IPAA tackles some key issues at Dallas ▸ 62

Computers streamline production work ▸ 64

West Africa's Togoland shows promise ▸ 166



This 260 GPM Gaso actually pumps 374,400 gallons a day... day after day

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OIL AND GAS JOURNAL
Vol. 58, No. 43

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TECHNOLOGY—OPERATION

Refining-Processing

SPECIAL SECTION: Report on Refinery Maintenance 85-103
By H. C. Bozeman

Refinery Maintenance Comes of Age 85
Refiners are calling for more efficient maintenance and getting it. Organizations and techniques are moving fast to meet the challenge of lower margins.

How to Organize for Maintenance 88
The small refinery largely follows central maintenance supervision and planning. The large refinery usually finds it advantageous to adopt zone organization, with decentralized supervision, but with central planning.

How to Train for Maintenance 92
New maintenance systems, new equipment, and new tools and techniques are changing training needs.

How to Carry Out Refinery Maintenance 95
New techniques in onstream inspection, onstream maintenance, and offstream maintenance.

What Maintenance Costs 100
Eight charts show trend in cost reduction over past 5 years.

Process Costimating—82 104
Types of refinery processing.

The Foreman's Page 106
Refinery chemistry—Part 5: Special properties of aromatics.

Underground Ammonia Storage Has Disadvantages 127
By Hugh S. Pylant
Six years of experience show problems and extra expense outweigh advantages.

Pipeline

Automatic Vapor-Pressure Instrument Controls Addition of Volatiles Into Crude Lines 108
By P. R. Scott

Drilling-Production

Stock-Tank Vapor-Recovery System is Practical 112
By R. C. McCutchan
Consolidation of lease batteries for LACT installations, unitization, and cost-reduction programs has brought large volumes of stock-tank vapors to central locations. This means that vapor-recovery systems can now be economical, and lease profits will go up.

Anhydrous Ammonia Can Halt Internal Casing Corrosion 117
By R. G. Loncaric, D. R. Anthony, M. D. Folzenlogen and Fair Calvin
A major producer of crude oil has stopped internal casing corrosion at a fraction of the cost of a well-repair job.

New High-Gel Cement Makes Casing Jobs Cheaper, Surer 124
By Ed McGhee

Shell's 14,000 Ft. of Open Hole Sets Record 128
By Ed McGhee

New Mud Organic—A Different Approach to Reducing Drilling Costs 129
By R. A. Jung

Reservoir Engineering—28 133
By E. T. Guerrero and F. M. Stewart

Oil-Well Pumping—20 139
By Joseph Zaba

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Oct. 24, 1960

Massive chess game is developing over oil at Beirut:

Speakers for Arab-producing countries all call for new pricing practices, changes in concession terms, and a change in the present system of things to give them more voice in the oil industry.

They see international proration as the answer. Under it the Arabs and Venezuela would divide up the oil market between themselves and bring about price stability.

But western oil companies aren't buying that approach. They diplomatically warn of the pitfalls and predict the oil industry will be running smoothly again (p. 59)*.

▼ ▼ ▼

The military is accused of making excessive purchases of foreign refined fuel oil and thereby hurting domestic refiners.

Union Oil chairman Reese H. Taylor has wired federal officials it's unfair to restrict domestic refiners' supply of cheap foreign crude and then allow the Supply Agency to buy cheaper products from foreign refineries.

Proposed changes in the presidential proclamation covering the oil-import program were at the White House at midweek. But adoption was expected soon.

Washington oil observers doubt that the changes will make any significant difference in present level of imports.

The American Legion has turned down a resolution supporting the coal industry's drive to get Congress to authorize a fuels policy study.

The resolution probably would have been adopted in routine fashion had not oil-industry representatives acted promptly after being tipped to the coal maneuver.

▼ ▼ ▼

A new stabilized silica-magnesia fluid cracking catalyst

*Refers to article in this issue giving more details. When no page is given, the item is a Newsletter exclusive.

will be commercially tested later this year.

The catalyst, containing about 28% magnesium oxide, in lab tests has given higher gasoline yields and less coke and gas than the 13% silica-alumina catalyst now widely used.

Higher effective activity maintenance and good regenerability also are claimed by its developer, Davison Chemical.

Refiners are calling for more efficient maintenance than ever to meet the challenge of lower margins.

Maintenance is moving towards more centralized planning and scheduling. At the same time there is more decentralizing of responsibility of field control. Increased efficiency also is coming in such other areas as training, onstream inspection, safety, plant upkeep, and emergency planning (p. 85).

▼ ▼ ▼

Chassis lubrication as it exists today is on its way out—marketers already are thinking of ways to replace its value in selling TBA and repairs to the motorist.

A suggestion by Socony Mobil's J. W. Lane: Promote a new 1,000-mile safety check and car inspection. During this check, non-chassis lube points can be covered, oil can be changed, and checks can be made for defective mufflers, tires, etc.

Credit expansion is being adopted by some oil firms, providing longer terms. But the idea of revolving credit as used by department stores is opposed.

Argument of oil credit managers: It would only increase investment in receivable accounts without increasing business.

▼ ▼ ▼

Texas oil producers are encountering their poorest year in the last decade.

Barring a sharp pickup in the next 2 months, the state production should hit 934,000,000 bbl. in 1960, about 5% below the 1959 level and slightly less than 1958 when the industry was readjusting to overproduction during Suez crisis.

Dollar income also will be down to about $2.8 billion from $2.95 billion in 1959. Gas sales, though up some, will not make up for the oil drop.

A new kind of service—contract field operations—is catching on fast in the oil industry.

It began as an occasional contract for a pumping job or well workover. Now independents and majors alike are hiring contractors to handle isolated wells or even run an entire field.

Reason: Contractors have shown they can do the job

cheaper than the companies (p. 68).

▼ ▼ ▼

Record drilling is getting routine in the Timbalier Bay area in the Louisiana offshore.

A Gulf Oil's No. 7 well on Louisiana State Lease 1773 was taken to 10,002 ft. in 3 days, 7 hours, 10 minutes. This cut about 5 hours from the previous drilling-speed record.

Ahead: A 10,000-ft. hole in 2½ days is not far off, say engineers of Dixie Drilling Co., which has the Gulf drilling contract on a day-work basis.

Best Devonian strike in 10 years' hunting in Williston basin may have been turned up at Murphy 1 Sletvold in Roosevelt County, Montana.

Well flowed 87 bbl. of oil an hour on test in the Nisku at 6,664-80 ft. (p. 165).

Drilling notes: New wildcats in Texas offshore areas are planned by Shell and Conoco (p. 71)...Wildcat completions jumped last week to highest level since last January. They totaled 222 and were 238 in mid-January.

▼ ▼ ▼

U. S. oil men generally are pleased by Government action last week banning shipments of most commodities to Cuba.

One reason: Government action would free them from fulfilling contracts to supply Cuba with lube oils, waxes, and oil equipment.

However, Government delay in imposing embargo may have given Cubans time to stockpile scarce refinery parts and other items. Also, since Canada has not yet joined U. S. action, Canada may become a source of supply for some Cuban oil needs.

Economics of a proposed crude line linking western Canada to the Montreal market has been disputed by Imperial Oil.

Its argument: The line would impose a $50-million annual burden on Quebec consumers. Reserving the Montreal market for western crude would mean either a tariff system, transport subsidies, or a complex quota system (p. 61).

▼ ▼ ▼

Industry notes: California Standard has organized California Oil Co. to take over activities of its four subsidiaries in the Rockies and Central Plains states...The API will give Eugene Holman its Gold Medal next month in Chicago...Delhi-Taylor is moving to acquire assets of Three States Natural Gas Co., Dallas. Delhi-Taylor bought 40% of the outstanding shares last month, will make an offer on the rest as soon as evaluation studies are completed.

Market Memo

Oct. 24, 1960

Firmness is featuring product prices.

It's the tightest "hold-the-line" price policy seen for mid-October since the Suez affair.

The tight crude market and almost certain higher labor costs before the year is out are forcing refiners to hold their product inventories for a good price.

Sign of the times: Tidewater grabbed a spot offering of Canadian crude last week for delivery down the river to its Westwego, Louisiana, terminal...Signal is now moving 1,000 bbl. daily of Wyoming crude by pipeline to Wood River and then by barge to Houston.

The Gulf Coast gasoline market got a contraseasonal shot in the arm with purchase of two T-2's of split housebrand and premium gasoline for prompt lifting at posted prices. Esso was the buyer—Southwestern and Republic the sellers.

On the Gulf, 92-RON gasoline is being offered and sold at posted 11.25 cents per gallon. At least three T-2's are available from independents at this price.

Light fuels are poised for a price advance. No. 2 is strong at posted 8.25 cents per gallon but not moving. No. 6 at $2.30 per bbl. is still strongest product on the coast.

Mississippi River markets are marking time, waiting on the weather.

Kerosine and No. 2 are being held for one-quarter cent over their respective Gulf Coast lows. This would price kerosine at 9.25 cents and No. 2 at 8.50 cents. A few spot deals are reported at these prices.

But 92-RON gasoline is offered quietly from some mid-river points at one-quarter cent off Gulf Coast low or 11 cents.

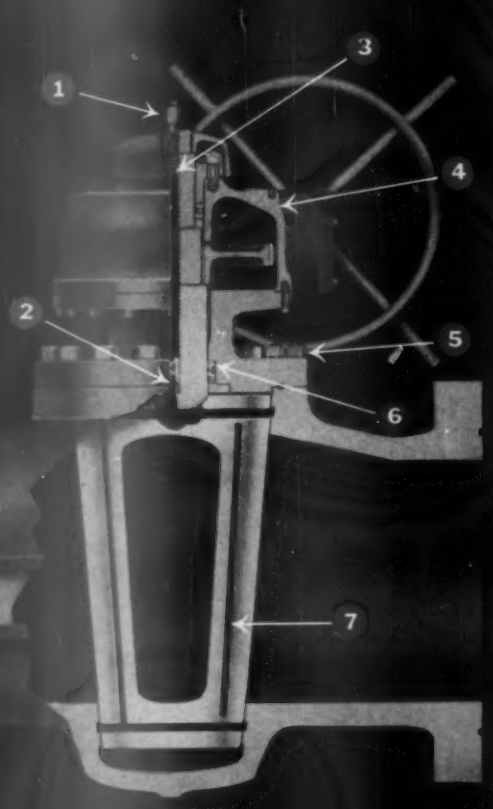
Group 3 northern-shipment gasoline is in a firm price position for late October. The going price is 12.25.

Middle distillates are inactive but firm at their posted levels of 10 cents for No. 1 and 9 cents for No. 2.

In Chicago, discounts of one-quarter to one-half cent on gasoline have not been sufficiently prevalent to change the 92-RON posted price at 12.625 cents.

No. 1, posted at 10.25 cents, and No. 2, posted at 9.50 cents, are subject to one-quarter cent discounts by limited sources.

7 characteristics that make WALWORTH a better Lubricated Plug Valve



1. Valve can be lubricated with a Walworth High Pressure Lubricant Gun without removing lubricant fitting.

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4. For buried pipelines—gear housing design permits simple attachment of lubrication and handwheel extensions without modifying the gearcase.

5. Standard bolt threads, rather than fine threads, means easy replacement of nuts and bolts from local stocks.

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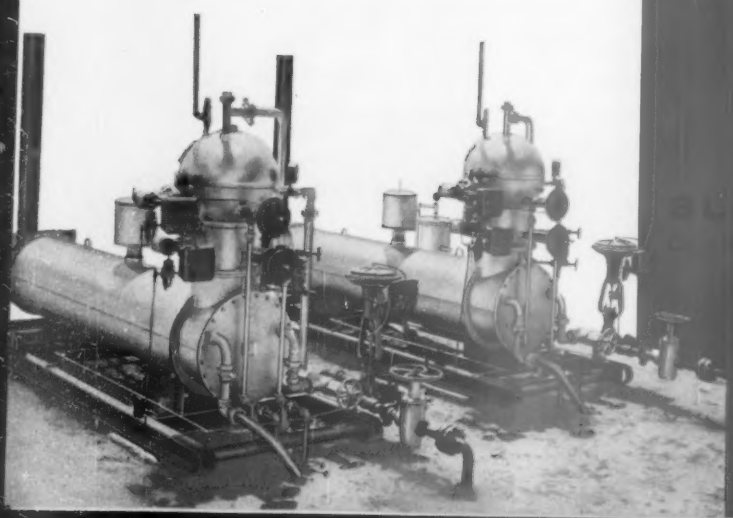
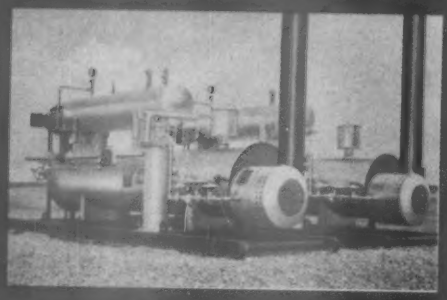


Prevents equipment freeze-ups, shut-downs and service calls



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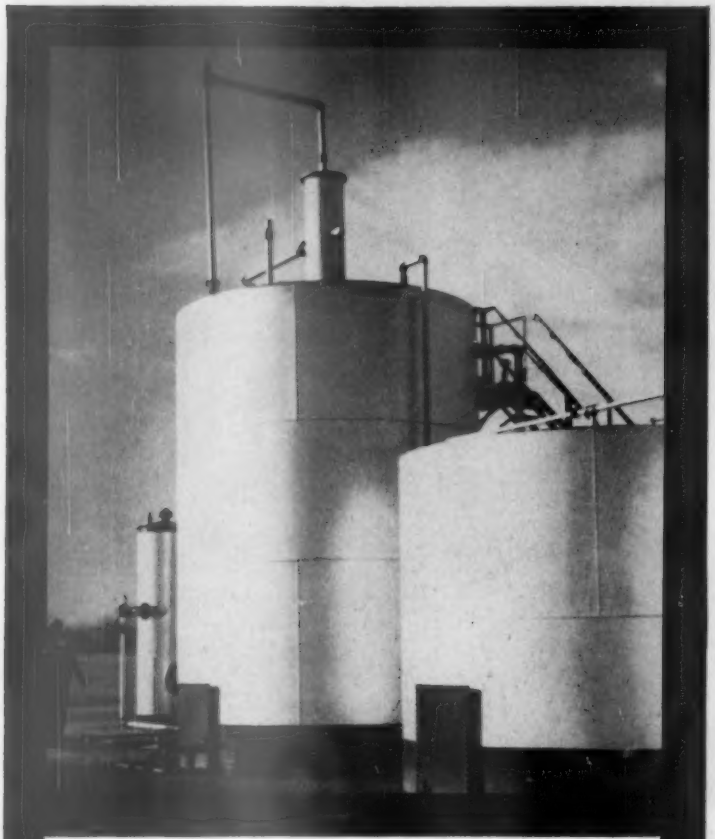

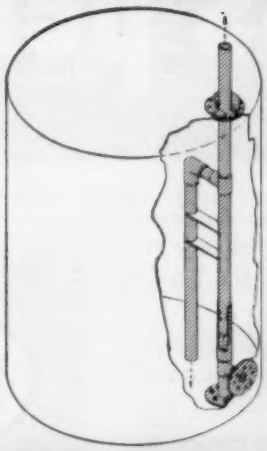

Siphons are fabricated of piping and fittings of Geon by Green Contracting & Engineering Company, Wichita. B.F.Goodrich Chemical Company supplies the Geon vinyl.

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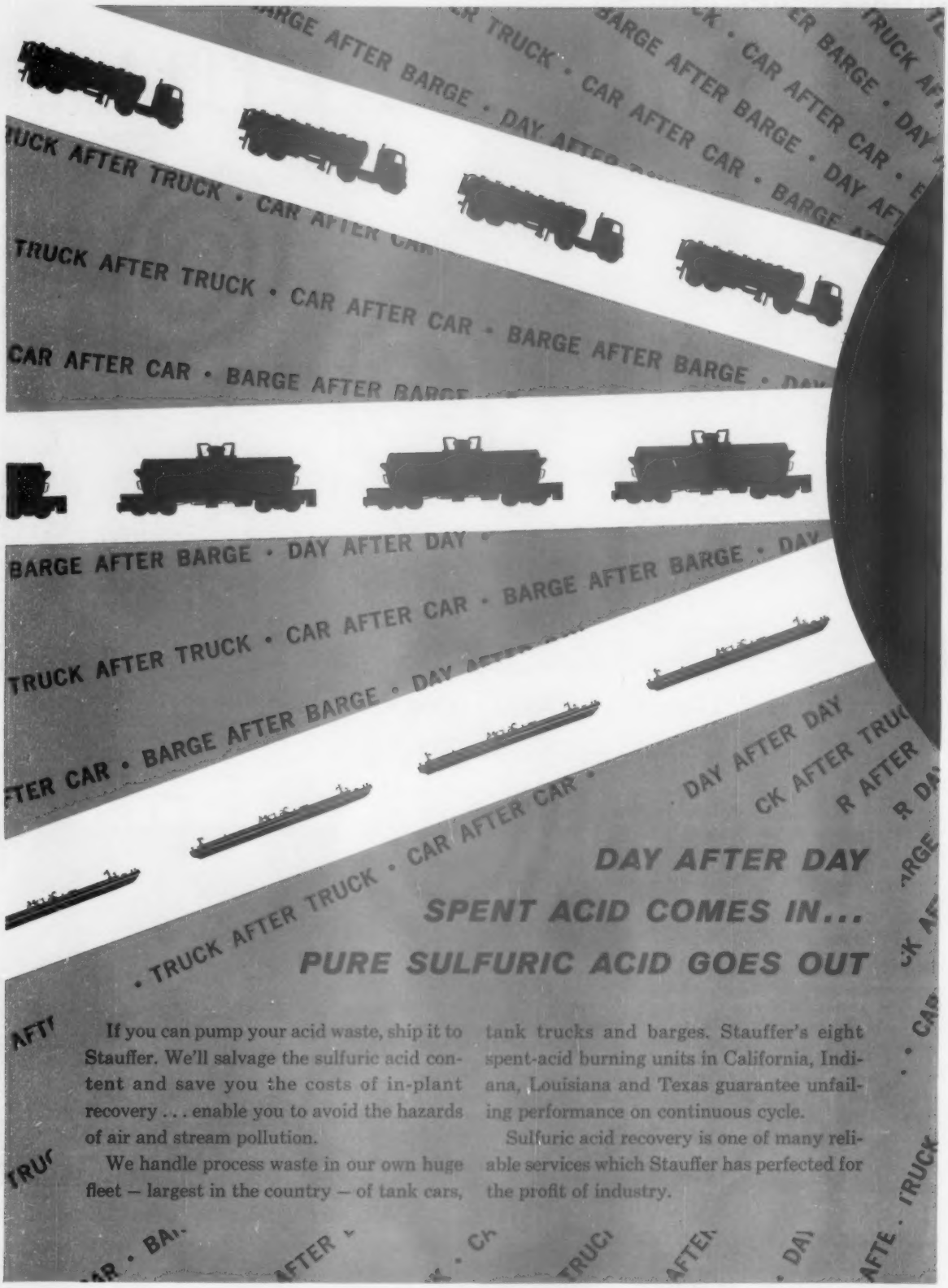
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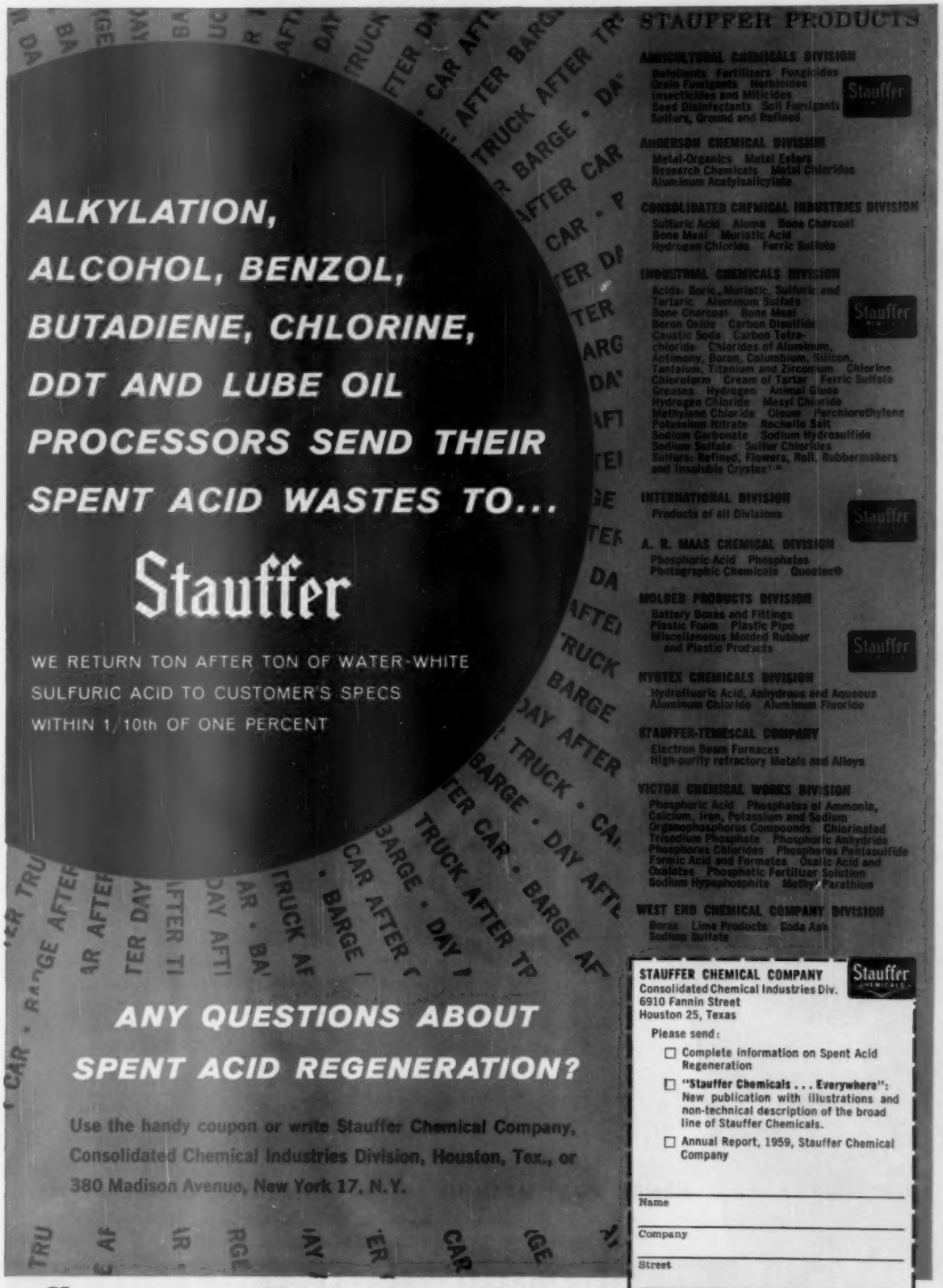
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Bone Charcoal Bone Meal
Boron Oxide Carbon Disulfide
Caustic Soda Carbon Tetra-
chloride Chlorides of Aluminum,
Antimony, Boron, Columbium, Silicon,
Tantalum, Titanium and Zirconium Chlorine
Chloroform Cream of Tartar Ferric Sulfate
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Plastic Foam Plastic Pipe
Miscellaneous Molded Rubber
and Plastic Products
NYOTEX CHEMICALS DIVISION
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Aluminum Chloride Aluminum Fluoride
STAUFFER-TEMESCAL COMPANY
Electron Beam Furnaces
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Organophosphorus Compounds Chlorinated
Trisodium Phosphate Phosphoric Anhydride
Phosphorus Chlorides Phosphorus Pentasulfide
Formic Acid and Formates Oxalic Acid and
Oxalates Phosphatic Fertilizer Solution
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Complete information on Spent Acid Regeneration
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75 YEARS OF SERVICE TO INDUSTRY AND AGRICULTURE
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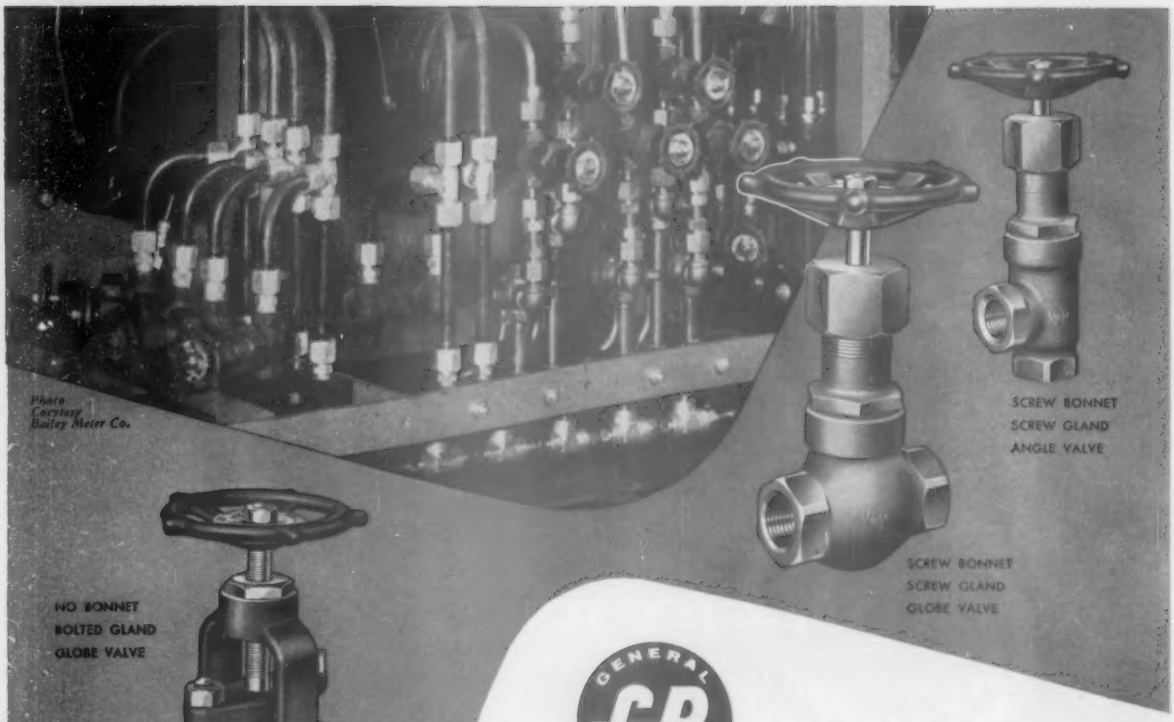

Photo Courtesy Bailey Meter Co.

SCREW BONNET
SCREW GLAND
ANGLE VALVE

SCREW BONNET
SCREW GLAND
GLOBE VALVE

NO BONNET
BOLTED GLAND
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GENERAL GP PURPOSE

FORGED STEEL *INTEGRAL SEAT* METER AND GAUGE LINE VALVES

Union Bonnet, Screw Bonnet and No Bonnet Types

UNION BONNET
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GLOBE VALVE

Service proved Vogt GP Forged steel valves are the choice of leading meter and gauge Manufacturers for top performance and unfailing reliability.

They are available in sizes from ¼" to 2" of carbon steel for general purpose duty and of all-stainless where highly corrosive liquids are involved. All stems are one-piece 13% Chrome Stainless Steel with fine pitch threads for accurate regulation of flow. Special packing is furnished when specified.

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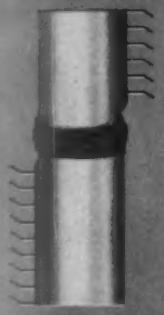
Vogt FORGED STEEL VALVES, FITTINGS, FLANGES and UNIONS

RECIPO WALL CLEANER



ROTO WALL CLEANER

MINIMIZE REMEDIAL SQUEEZE JOBS...

Specify Halliburton Wall Cleaners

a reminder
Call Halliburton for Wall Cleaners

S-3 CASING CENTRALIZER

EZ LOK LIMIT CLAMP

The best way to minimize time and money often spent in remedial work is to give your well a good beginning with a better primary cementing job using these Halliburton casing tools...

HALLIBURTON RECIPO WALL CLEANERS
... designed to remove filter cake from the well bore as the casing is reciprocated before and during cement placement. The stout rubber fingers of these tools scrape and scour away one of the prime causes of cement channeling.

HALLIBURTON ROTO WALL CLEANERS
... equipped with a multitude of metal fingers, they are designed to rotate with the casing and scratch away the filter cake that so often prevents good cement bonding.

HALLIBURTON S-3 CASING CENTRALIZERS
... help keep the casing centered all the way down so that the wall cleaners can do their most effective work.

HALLIBURTON EZ LOK LIMIT CLAMPS
... used to install auxiliary tools on the casing string. They are easy to install – and are designed to *stay put* during the job... even in the deepest wells.

*Specify **HALLIBURTON CASING TOOLS** ... designed by the people who know cementing best.*

275 SERVICE CENTERS
JUST MINUTES AWAY
FROM YOUR WELL.

CEMENTING SERVICES

Halliburton
COMPANY • DUNCAN, OKLAHOMA

Pumping 12,000 bwpd

at GULF OIL CORPORATION
water flood station, Crane, Texas

ROILINE ENGINES

• At their water flood station, near Crane, Texas, Gulf Oil Corporation, Midland, Texas, is using ROILINE engines to pump 12,000 bwpd at 600 psi. The Johnson turbine pumps are driven by two Model L-3460 ROILINE engines, each delivering 325 hp at 1000 rpm burning natural gas. These are 12-cylinder V-type engines of 3468 cu. in. displacement with a 7¼-in. bore x 7-in. stroke (see illustration at left). Their modern, basically simple design means all-around dependability combined with high fuel economy and long service life.

Send for literature • *SEE YOUR ROILINE ENGINE DISTRIBUTOR* 497

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Factories: Waukesha, Wisconsin and Clinton, Iowa

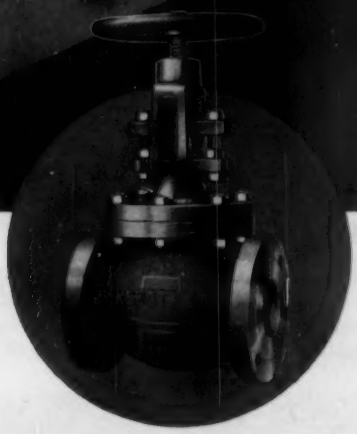
Before any Kerotest cast steel globe valve goes on stream, it's tested and approved in this final three-phase hydrostatic test. Here, with valve open and flanges blanked, the shell is subjected to maximum specified water pressure. The valve disc is then closed and the seat seal is checked hydrostatically and by air.

This testing stand adjacent to the production line is but one of the many quality control procedures employed at Kerotest to insure soundness of castings, seat seals and other operating parts. What's more, Kerotest's advanced design features bring you more precise flow control and regulation, reduce maintenance to a new low and assure longer valve life in all types of applications.

Kerotest Cast Steel Globe Valves

High quality Kerotest cast steel globe valves are available in primary service pressure ratings ranging from Series 150 to Series 1500. They are supplied in various combinations of body and trim material for all types of service in oil, gas, steam, water, chemical, petro-chemical, marine and industrial installations.

Send for your free copy of the new, informative Kerotest booklet. It's packed with working tables, dimensions, specifications and other helpful information.



KEROTEST
Quality Controlled Features

- Reinforced sections protect against unusual line strains, erosion and corrosion.
- Built for repacking under pressure in the full open position.
- Deep stuffing box for greater packing life and tighter seal.
- Threaded shoulder seating type seat rings replace without removing valve body from line.

There is a Kerotest Cast Steel Valve available for every class and condition of service.

KEROTEST MANUFACTURING COMPANY

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KEROTEST®

Trinity
LITE-WATE
A Complete
LOW-DENSITY CEMENT

No loss to weak formations

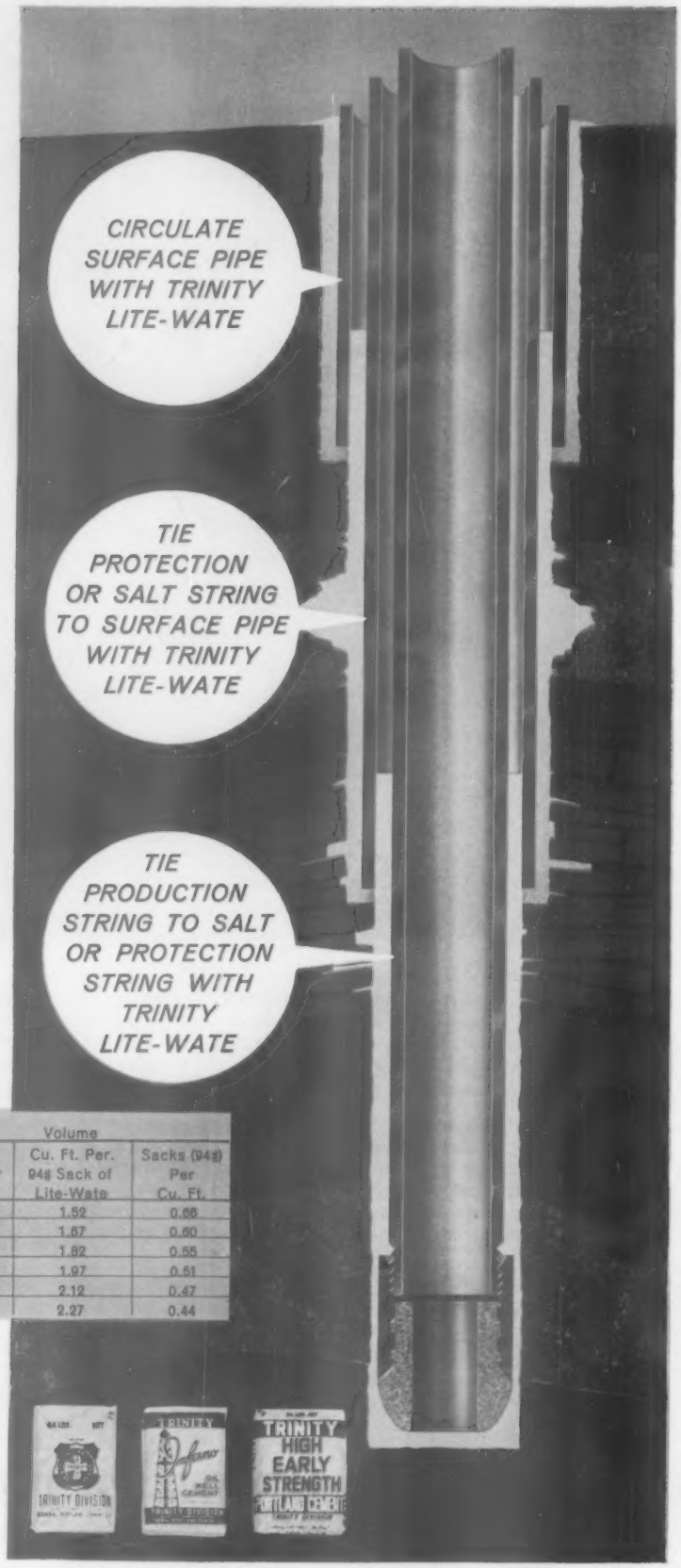
Trinity Lite-Wate is a neat oil well cement with a low slurry density. Nothing to add but water. It derives its light weight properties entirely from the high quality raw materials from which it is made. Easy mixing, easy pumping, can be circulated with low pump pressure and without loss to weak formations. It has proved satisfactory in circulating the surface pipe, tying protection or salt string to surface pipe and tying production string to protection or salt string.

Trinity Lite-Wate has been in use for several months in such varying well conditions as found in West Texas, Oklahoma, East Texas, Louisiana, Gulf Offshore and New Mexico, it has produced returns in *every case* where attempted.

SLURRY PROPERTIES

All slurries were mixed in accordance with procedures in API RP 10B. Slurry weight and volume were calculated on the basis of Lite-Wate specific gravity of 2.80.

Mixing Water			Volume		
Per cent	Gallons Per 94# Sack of Lite-Wate	Initial Viscosity Poises	Slurry Wt. Pounds per Gallon	Cu. Ft. Per. 94# Sack of Lite-Wate	Sacks (94#) Per Cu. Ft.
65	7.33	13	13.66	1.52	0.66
75	8.46	6	13.18	1.67	0.60
85	9.58	4	12.77	1.82	0.55
95	10.72	3	12.44	1.97	0.51
105	11.84	2	12.14	2.12	0.47
115	12.97	1	11.89	2.27	0.44


CIRCULATE SURFACE PIPE WITH TRINITY LITE-WATE
TIE PROTECTION OR SALT STRING TO SURFACE PIPE WITH TRINITY LITE-WATE
TIE PRODUCTION STRING TO SALT OR PROTECTION STRING WITH TRINITY LITE-WATE
TRINITY DIVISION
TRINITY
TRINITY HIGH EARLY STRENGTH

TRINITY

PORTLAND CEMENT DIVISION
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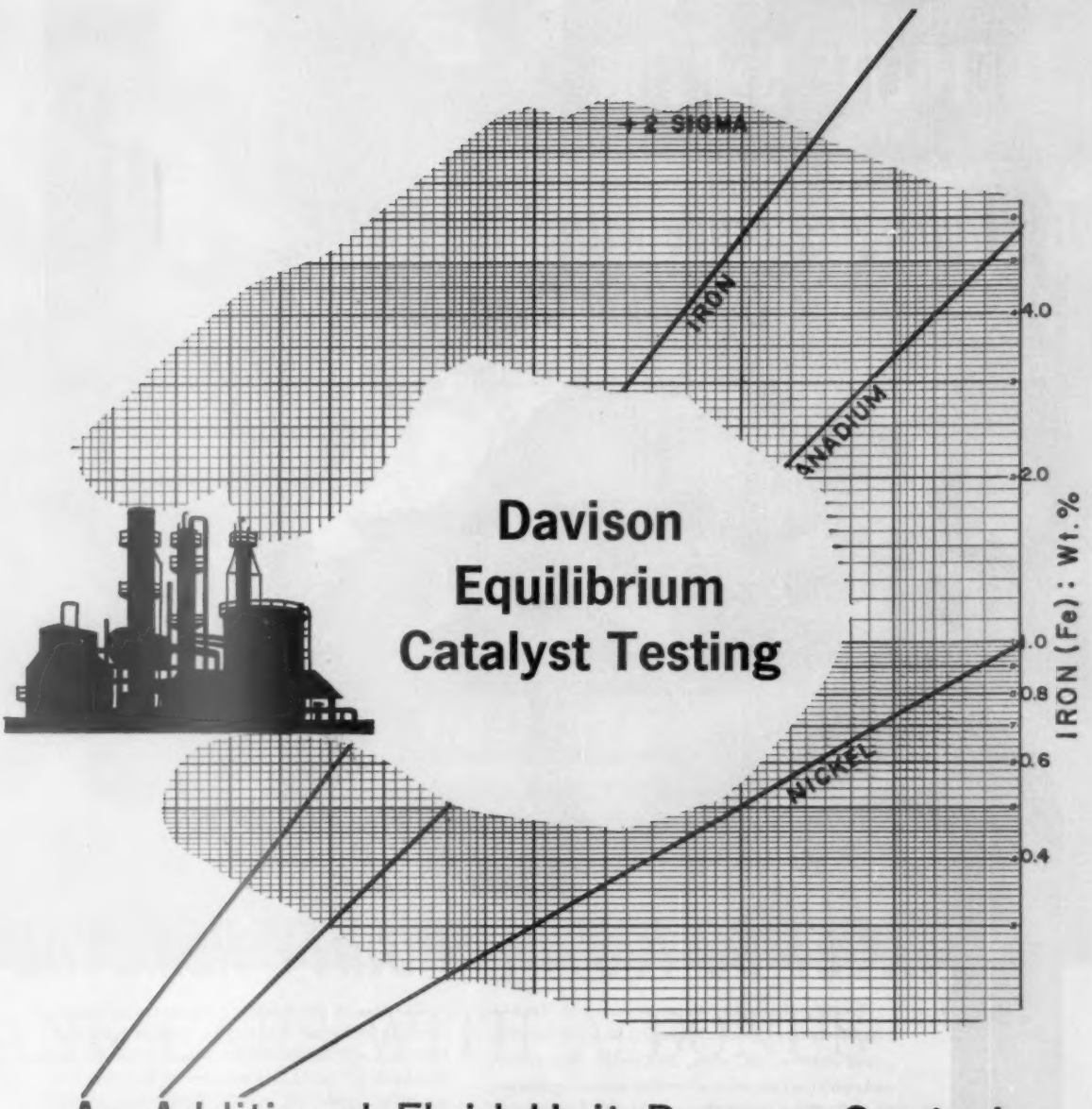

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Improve *conversion—selectivity—regeneration—fluidization* with the aid of this valuable Davison service. More than half of the fluid unit operators in North America rely on Davison Equilibrium Catalyst Testing. Find out how you can benefit. Ask your Davison representative or write Department A-10.

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another
TRETOLITE SERVICE
report

Treat charging crude with TRET-O-LITE Desalting Chemicals...

...GET 98-100% IMPURITY REMOVAL

Treating the crude charge stream with TRET-O-LITE* Desalting Chemicals keeps it 98-100% salt-free —and removes silt, silica, iron oxide, iron sulfide, and significant amounts of catalyst-poisoning arsenic, as well. Maintaining this remarkably low level of impurities allows refinery equipment to operate at peak efficiency, substantially reduces down-time due to fouling and corrosion damage, and produces better product quality.

*Registered trademark, Petrolite Corporation

TD-60-2

The Man in the Red Car is an expert on refinery desalting problems. Ask him to conduct laboratory tests that will determine the proper formulas and quantities of TRET-O-LITE required for desalting your particular crude oil stocks. Progressive refiners throughout the world rely on Tretolite assistance to treat more than 1,500,000 barrels of crude daily—at an average cost of 1.3 mills per barrel.

Equipment for Tretolite chemical desalting, as well as Petreco electric desalting, is designed and distributed by Petreco Division of Petrolite Corporation.

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TANK CARS WITH A BONUS

When these familiar yellow and green Du Pont tank cars are spotted at your blending plant, the bonus they represent in technical, training and marketing services can be as valuable to *you* as the tetraethyl lead itself is to your gasolines.

These services are available to you, a Du Pont TEL customer, as aids in your planning and operations —from blending plant to consumer. They include:

At the refinery, our technical staff can assist you in blending plant design and construction, in continuous gasoline blending operations and linear programming, for example. They can also offer road octane survey data plus blending improvement know-how through Du Pont's petroleum additives research.

Training aids for Du Pont TEL customers include programs for blending plant personnel, lead hazard clinics plus visual aid and related materials to supplement your own training programs on the safe handling of tetraethyl lead.

Marketing data include surveys on why motorists buy certain brands, how service station operators can turn customers' car worries into sales advantages, plus many other facts. Fuel and lubricant specialists are also ready to help you sell fleet customers.

For more information on this bonus of service, contact your nearest Du Pont representative, or write to: E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

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Better Things for Better Living
... through Chemistry

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and other
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What's behind the demand for

CF&I Seamless Casing and Tubing?

Look at the company and what it represents. For the petroleum industry, the Image of CF&I stands for a high grade of seamless casing and tubing. The steel used is made by CF&I. Manufacturing facilities and equipment are among the most up-to-date in the industry. CF&I's production techniques feature unusually exact quality controls. For special technical problems, CF&I offers expert engineering services.

CF&I's mill is ideally situated in Pueblo, Colorado. Around it, a thousand miles in every direction, stretch the rich oil fields of North America. This location facilitates rapid delivery, either by rail or truck, even to the most remote sites. All CF&I Seamless Casing and Tubing is made to API specifications. It's available in sizes 2⅜" to 9⅝" O.D. Get full details from a CF&I Sales Representative or your local distributor.

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CF&I STEEL **SEAMLESS** *casing and tubing* API

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Quick quiz tells whether you're paying more than you need for Gas Distribution Pressure Recorders

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☐	☐	Can you get easy-to-read 12" charts without paying extra?	from Foxboro you can!
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A check in the "NO" column means your Foxboro field engineer can save you money —why not call him? The Foxboro Company, 6010 Neponset Ave., Foxboro, Mass.

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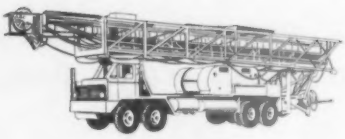
The Man Who . . .

PULLS OIL WELLS OUT OF TROUBLE.

When you're in trouble you look for a friend that you can depend on . . . **just as oil men depend on servicing contractors to keep their wells pumping at top efficiency. And, experience teaches that the most dependable contractor is the one with good equipment . . .** **like Franks . . . equipment engineered and built to keep the contractor as well as the producer out of trouble. So, next time you are faced with servicing problems, look for** **proven dependability. Ask the man who uses Franks . . . about the equipment that keeps him out of trouble.**



WELL SERVICING AND DRILLING UNITS

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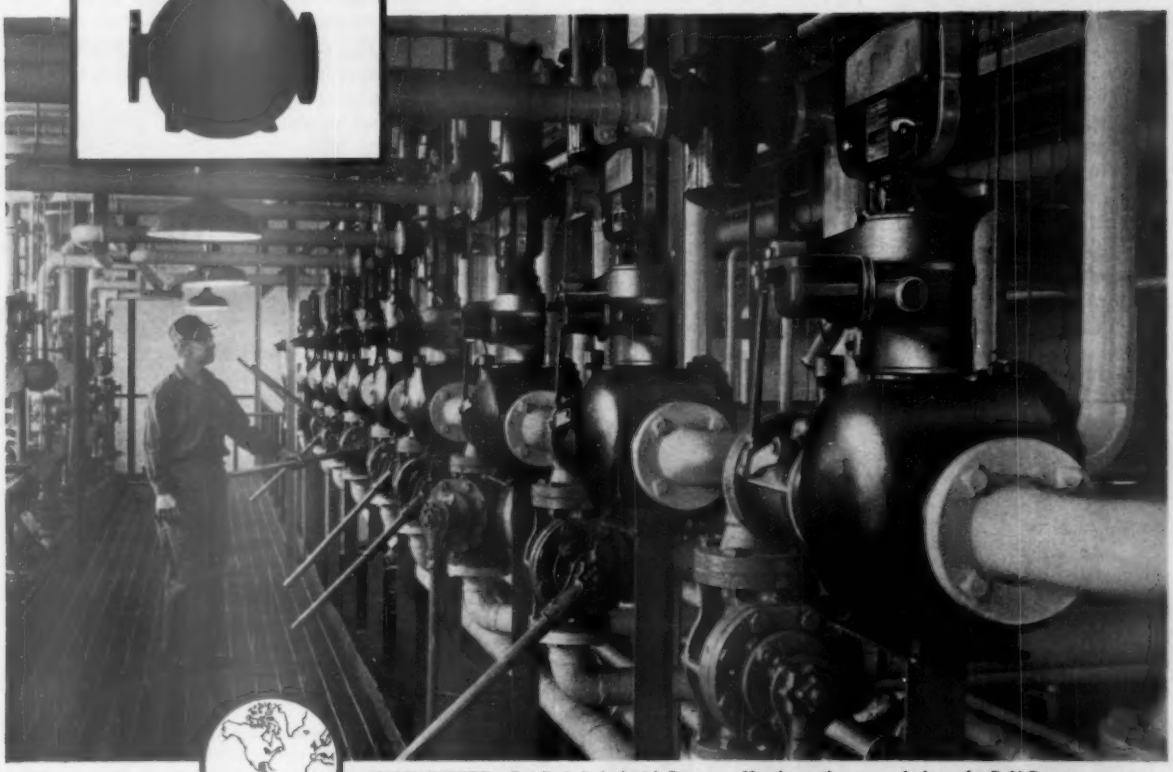
CABOT CORPORATION
MACHINERY DIVISION

How BRODIE BiRotors and VALVES are Important to Control of Lube Oil Blending and Compounding

Seventeen B-62D meters plus accessories handle lube oil base stocks and additives at Gulf Oil Corporation's refinery, Port Arthur, Texas



EVERYWHERE – *Brodie is linked with Progress. Here's another example from the Gulf Coast.*

Brodie *BiRotors* are used on component lines in this modern Gulf installation to meter the required amounts into the proper blends. In this operation Brodie meters are an important factor in the over-all blending and compounding system. Equipped with shock-free Quantrols and Automatic Temperature Compensators, Brodie *BiRotors* and accessories have become the basic standard equipment needed to develop accurate blending of many products. Call Brodie today.

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BRODIE
METERS-VALVES

REPRESENTATIVES WITH STOCKS AND SERVICE FACILITIES IN ALL PRINCIPAL CITIES

See why ALCOA ALUMINUM makes a good design habit

Requirement: metal pipe and tube to insure corrosion-free fluid handling at low initial cost and minimum upkeep

Key to good design: specify low-cost, trouble-free tubular products of Alcoa Aluminum

The overpowering volume of pipe and tubing needed in the process industries makes it one of the biggest single material investments in most plants. Historically, the repair, maintenance and replacement of piping systems has been too, one of the biggest causes of an alarming increase in maintenance costs. Both factors make vital a clear understanding of the rather remarkable advantages of aluminum pipe and tube.

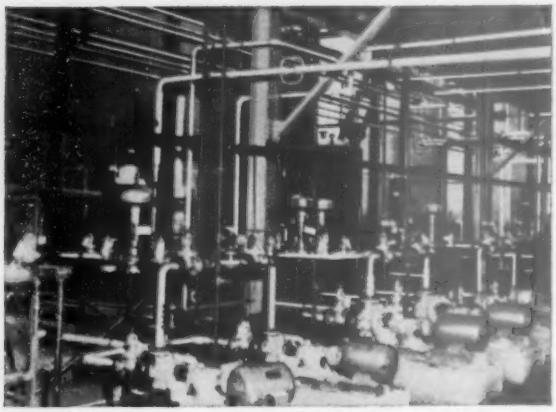
First of all, from a cost standpoint, aluminum is very frequently the lowest cost material suitable for a wide variety of applications in moving fluids through a plant. Consider, for example, the fact that the initial cost of aluminum may often average as much as 50 per cent less than that of admiralty for identical applications. Even greater savings apply when other metals such as stainless or mild steel are compared with aluminum.

Beyond these initial cost savings, aluminum provides significant maintenance benefits. For instance, no other commonly used metal offers aluminum's great resistance to corrosion. And the corrosion resistance for specific alloys exposed to particular environments can be determined from a substantial body of factual service data accumulated by ALCOA over the past 40-odd years.

It is hardly surprising that aluminum, in a variety of tubular forms, is gaining the confidence of more and more designers and builders in the process industries . . . as suggested by the aluminum applications described on these pages. ALCOA's engineers are anxious and willing to share their factual knowledge of aluminum which inspires this confidence. They are doing so through a series of engineering conferences being held this year in major cities around the country. Your local ALCOA sales office will be happy to furnish details.

You may also wish to avail yourself of the body of ALCOA literature which describes in technical detail the known performance characteristics of aluminum in a variety of process industries applications. Simply fill in and mail the coupon opposite.

World wide sales through ALCOA INTERNATIONAL, INC., 230 Park Avenue, New York 17, N.Y.

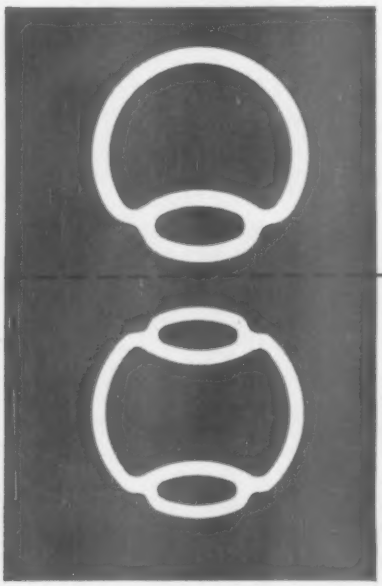


Process piping of Alcoa Aluminum is shown here in a system designed to handle liquid sugar. The natural corrosion resistance of aluminum prevents contamination of the syrup, insures long service life and prevents excessive maintenance. Its scavenging action reduces undesired heavy metal contamination, thereby improving the end product. And aluminum's low friction factor permits fast flow without excessive pumping costs.

This aluminum pipeline is shown being welded and laid in Lake Maracaibo, Venezuela. Aluminum—without special coatings—has proved highly suitable for this operation because it resists so well the corrosive attack of the brackish waters in the lake. Since no coating is required, the low initial cost of the aluminum has proved a significant benefit. The light weight of the aluminum pipe speeded laying operations, and it has no vulnerable coating which would require babying the pipe.

Alcoa Aluminum jacketing keeps the thermal insulation on these large diameter steam lines fully effective. The light, bright aluminum jacketing shields over 5½ miles of piping and insulation from rain, snow, dirt and ice while providing effective protection against a highly corrosive industrial-marine atmosphere.

New UNISTRENGTH pipe by Alcoa now makes it possible to design low-cost welded aluminum lines with uniform bending, bursting and tensile strength throughout their length. The secret is a reduction in wall thickness everywhere but at the ends where it is needed to overcome the local reduction in strength caused by the heat of welding. The result is aluminum piping which weighs up to 40% less but provides equivalent design strength.

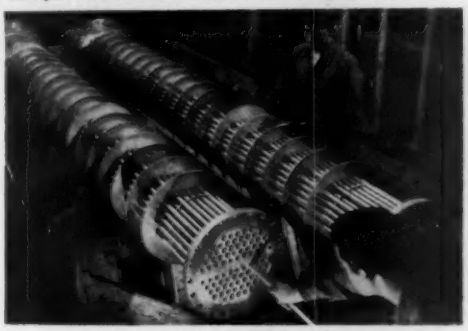


Alcoa UNITRACE is the light, strong, corrosion resistant pipe which provides steam and product passages in a single extruded unit. It has proved an excellent way to cut cost and improve the efficiency of steam traced lines—by eliminating costly external steam jackets or inefficient tracer tubes. Now a new product,

Alcoa DUOTRACE makes possible the same important benefits in steam traced systems where recirculation is desirable. As shown, DUOTRACE provides two trace passages plus the product passage in one extruded unit. Flange and Trace Cap fittings compatible with conventional piping are available for both UNITRACE and DUOTRACE.

Design Note: Consider UNITRACE and DUOTRACE as low-cost successors to both heat exchangers and preheaters.

Alcoa Aluminum heat exchanger tubing is frequently the lowest cost material with suitable corrosion resistance for a variety of heat transfer applications. Moreover, aluminum frequently displays significant extra benefits—as in this pair of aluminum oil-to-oil exchanger bundles for preheating vegetable oils. Here, the aluminum alloys have no catalytic effect on the oxidation of the vegetable oil.



Aluminum Company of America, 865-K Alcoa Building, Pittsburgh 19, Pa.
Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries:

- ☐ 10197 Aluminum Pipe and Fittings
- ☐ 34-10418 Alcoa Unitrace: Combines Piping and Tracing in One Unit
- ☐ 10270 Alcoa Utilitube
- ☐ 10460 Process Industries Applications of Alcoa Aluminum
- ☐ 20849 Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres
- ☐ 20265 Have You Tried Aluminum in your Refinery?
- ☐ 20437 Aluminum Alloy Heat Exchangers in the Process Industries
- ☐ 20272 Aluminum Alloys for Handling High Purity Water
- ☐ 21090 Resistance of Aluminum Alloys to Fresh Waters
- ☐ 10130 Forming Alcoa Aluminum
- ☐ 19416 Brazing Alcoa Aluminum
- ☐ 19415 Welding Alcoa Aluminum
- ☐ 19051 Alcoa Aluminum Handbook

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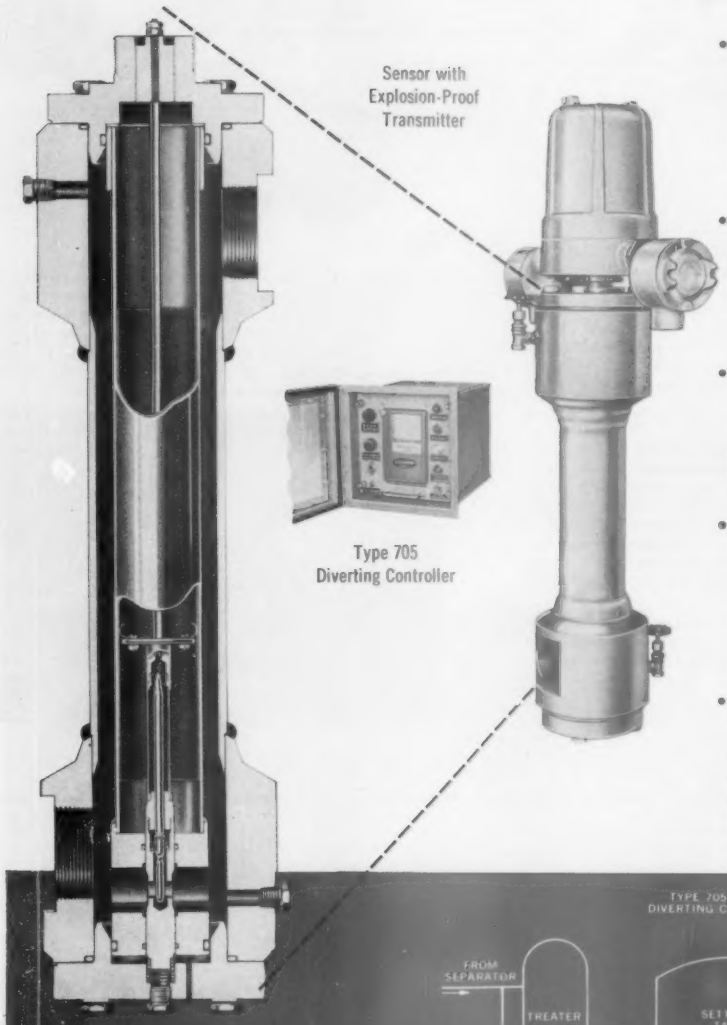
ALUMINUM COMPANY OF AMERICA

For exciting drama watch "ALCOA THEATRE" alternate Mondays NBC-TV, and "ALCOA PRESENTS" every Tuesday, ABC-TV

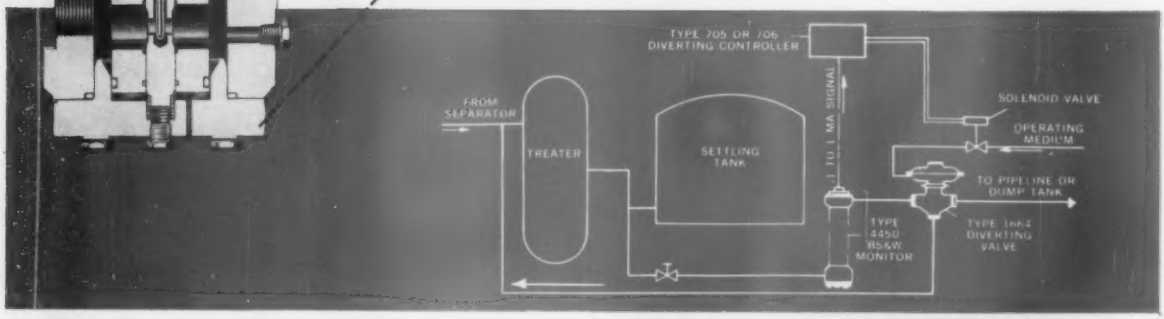
Exclusive FISHER BS&W Monitor Design

REDUCES WAX BUILD-UP... ASSURES ACCURATE MEASUREMENT

FISHER *type* 4450-705 BS&W MONITOR



- **VIRTUALLY NO WAX BUILD-UP ON SENSING ELEMENT** . . . provides unimpeded flow of fluid through measuring cell. Gives continual stable calibration because foreign material does not build up on measuring section.
- **MEASUREMENT ACCURACY WITHIN 0.03% BS&W CONTENT**. . . can detect changes in water content to 0.002% BS&W. Meets all API specifications for BS&W monitoring.
- **AUTOMATIC TEMPERATURE COMPENSATION AT NO EXTRA COST**. . . dependable mercury thermometer automatically compensates for temperature variation of crude from 40° F. to 140° F.
- **SOLID STATE PRINTED CIRCUIT AMPLIFIER** . . . completely transistorized transmitter is mounted directly on sensing element, no coaxial cable needed. Eliminates need for compensation required with critical lengths of cable.
- **AUTOMATIC TIME DELAY...** diverting can be delayed from 0 to 5 minutes after excess BS&W has been indicated. Timer automatically resets itself each time BS&W falls below preset maximum.



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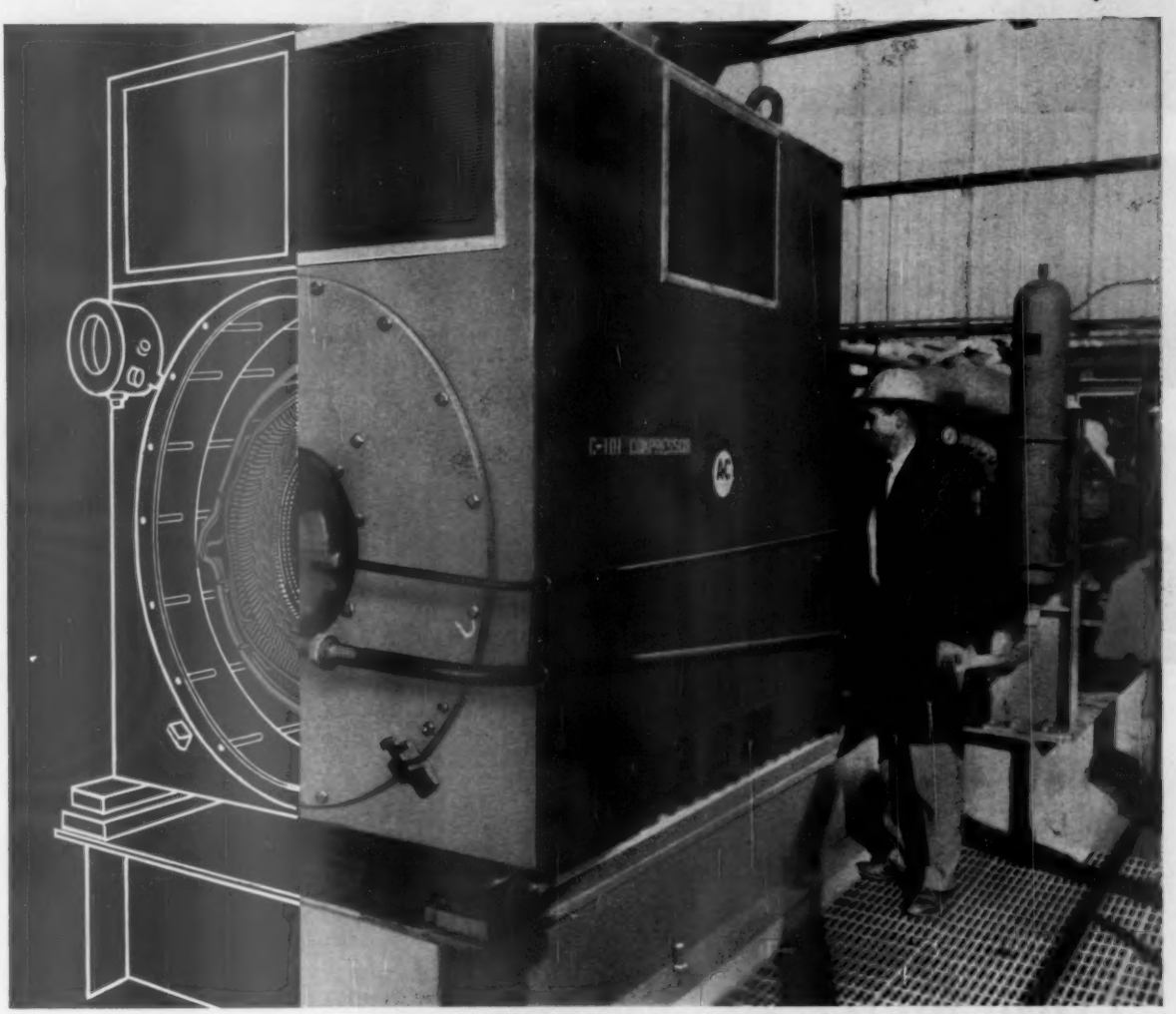
BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIPMENT CO., CORAOPOLIS, PA.

FISHER Controls

SINCE 1880

ALLIS-CHALMERS



Silco-Flex insulation in this refinery application has solved the problems of outdoor service — moisture, corrosive fumes, abrasive dust, and temperature extremes.

Your major motor investments are protected by Allis-Chalmers

invisible standards of perfection

Allis-Chalmers motors prove the value of thinking beyond established design standards. This thinking, applied to research, development and manufacturing, has led to advanced design features which mean greater application versatility, exceptional reliability and extended motor life. These are invisible standards of perfection you get with Allis-Chalmers motors.

Silco-Flex insulation, for example, has completely changed the rules on open-motor application. It is impervious to moisture, oils, and most acids, alkalies and solvents. It is resistant to abrasion, and is capable of withstanding high temperatures. Its resilience provides durability to withstand shock and vibration.

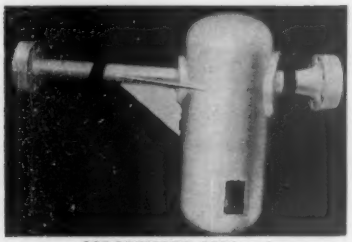
Super-Seal motors, with *Silco-Flex* insulation, have proved themselves for more than five years under the most severe conditions in industry.

Advancements such as capsule bearings, split end housings, and *Integrated* field coils (for synchronous motors) add to the superior performance of *Super-Seal* motors.

They contribute to the invisible standards that protect your motor investments year after year — cut replacement costs — assure uninterrupted production.

To learn more, call your nearby A-C representative, or write ***Allis-Chalmers,*** *Power Equipment Division, Milwaukee 1, Wisconsin.* A-1295

Super-Seal and *Silco-Flex* are Allis-Chalmers trademarks.



GAS PRESSURE, 1500 p.s.i.

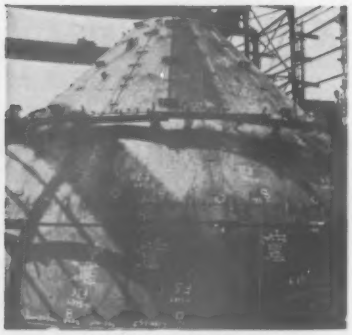
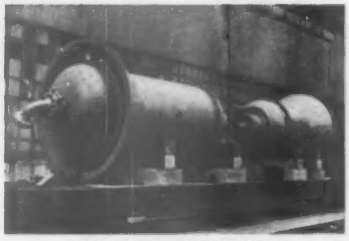


PLATE WORK, 55′ dia. cone

GALVANIZING POT

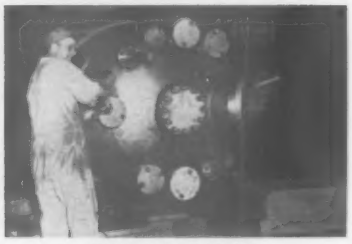
SPECIAL ALLOY STEEL DEFLECTORS

SPECIAL CHEMICAL VESSEL



SPECIAL STAINLESS VESSELS

TOWER, 8′6″ dia. x 154′ in length



STAINLESS AUTOCLAVE

SPECIAL CONDENSER

MACHINERY PARTS

WATER SHIPMENT

MADE TO ORDER EQUIPMENT FOR OIL REFINING & CHEMICAL PLANTS

We place at your disposal one of the largest and most thoroughly equipped plants of its kind, featuring advanced production methods with experienced personnel in all departments.

PRODUCTS—Towers, Stills, Condensers—Kilns, Heat Exchangers, Pressure Vessels, Plate Work—All Codes, Any Material, Special Machinery, Machine Work.

SPECIAL SERVICES—X-Ray Equipment—Stress Relieving Furnaces.

SHOPS—Boiler, Welding, Machine, Fabricating, Pipe, Blacksmith, Anglesmith, Sheet Metal, Copper, Separate Stainless Shop.

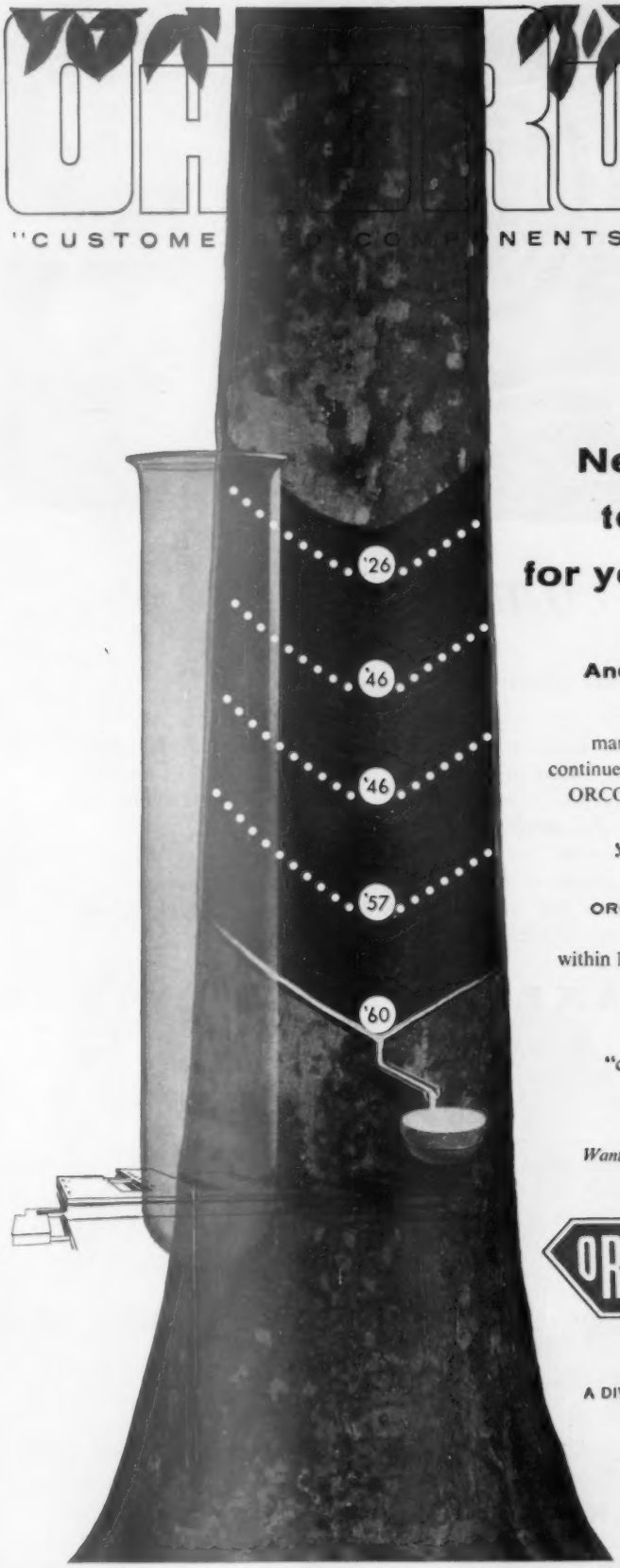
WATER AND RAIL SHIPMENTS—Our plant, including crane for loading and handling is located on the Delaware River with piers and deepwater to accommodate sea-going ships and railroad connections to all points.

SUN SHIPBUILDING & DRY DOCK COMPANY

CHESTER, PA.

OHIO RUBBER

"CUSTOME[illegible] CO[illegible]NENTS BASIC TO INDUSTRY"



New plant growth to tap for your rubber needs

And you made it possible!

Ohio Rubber's history of plant growth and manufacturing expansion dates back to 1926—continues through 1946 and 1957. And, in late 1960, ORCO opens its new Fort Smith, Arkansas plant—dedicated, as with the others, to serve you better—to supply your increasing needs for custom components.

ORCO SUM TOTAL: 5 major, geographically strategic plants . . . 1,200,000 square feet within 143 acres . . . over 2000 trained employees . . . diverse products of natural and synthetic rubber, neoprene, polyurethane, flexible and rigid vinyl . . . "customer-friends" like you across the board in industry, nationwide.

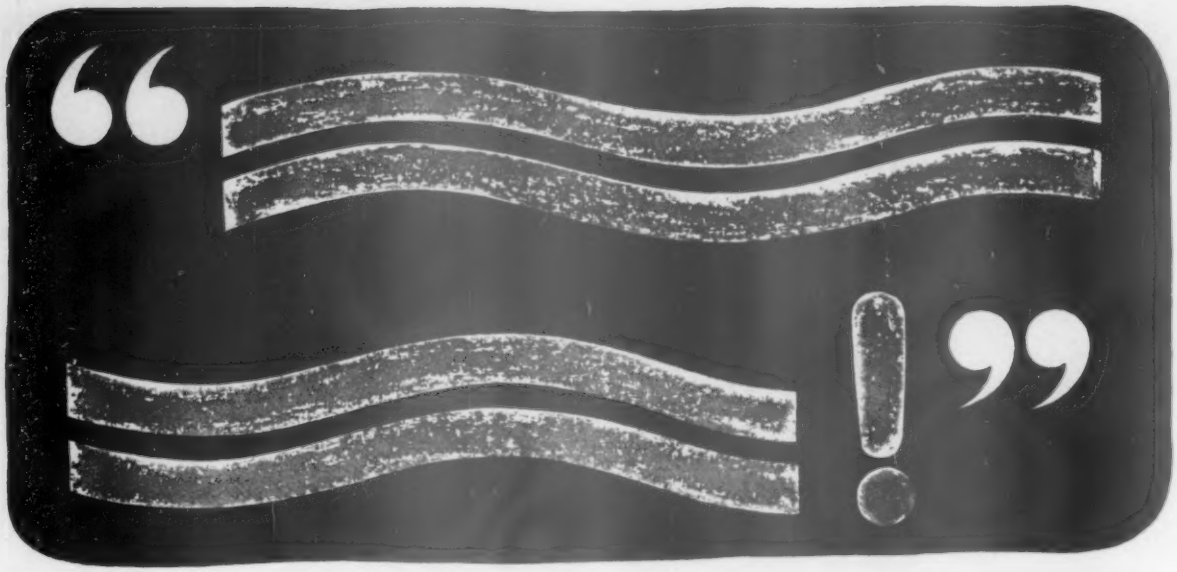
Want to know more about Ohio Rubber? Write today for our "Customeering" bulletin.

MF-200

ORCO THE OHIO RUBBER COMPANY

General Office • *Willoughby, Ohio* • WHitehall 2-0500

A DIVISION OF THE EAGLE PICHER COMPANY



Fluid, fluent communications...

the answer to greater understanding and effectiveness in engineering

Productive communications — the quick, accurate and understandable transmittal of ideas, conclusions and decisions — from drawing board to fabrication — play a vital role in the design and manufacture of Western Heat Exchangers . . . and are greatly responsible for the reputation Western enjoys for personal attention to the detail of each customer's needs.
Western's design, rating and service efficiency, as well as its quality of workmanship, depend upon maintaining "fluid, fluent" communications with our customers and our own personnel. We would be pleased to establish this "line of communication" with your engineering department, when you next require heat transfer equipment.

WESTERN'S STAKE IN YOUR FUTURE

. . . is in your young engineers — the engineering executives of tomorrow. In 1960, therefore, Western presents a series of messages on subjects of importance to the personal and professional advancement of all engineers. These messages, as shown at right, appear monthly in major trade journals, with a more complete treatment of each subject available in pamphlet form, singly or in quantities, upon request.

One of a series appearing in OIL & GAS JOURNAL, CHEMICAL ENGINEERING, PETROLEUM REFINER, REFINING ENGINEER, CHEMICAL ENGINEERING PROGRESS.

serving the growth of the process industry

WESTERN

HEAT EXCHANGERS

WESTERN SUPPLY COMPANY

P.O. Box 1888 – Tulsa, Oklahoma

Communicating your convictions gains better understanding, improved relations, greater results for engineers

Breathes there a man with soul so dead, who never to his friend has said, "Don't those lamebrains in the_____ Department ever get ANYTHING right? . . . I very carefully wrote EVERYTHING down, very logically and clearly . . . didn't leave a thing out . . . and they still don't get my point!" — or words to that effect?

The only qualification you need for having voiced these sentiments is that you occupy yourself daily with one or

Positive Shut-off at High Temperatures

WEDGEPLUGS
give positive control without lubricants

Wedgeplugs are proven performers on coking and catalyst lines:

No lubricants required for absolute control. Plug lifts, turns and reseats in one quick, easy operation.

Non sticking. Self-adjusting operator compensates for variable temperature. Will not stick on coking services.

Protected seats prevent valve-killing erosion of dry and fluid catalysts—a constant problem and expense when gate valves are used. With Wedgeplugs, you eliminate this extra maintenance cost.

Wedgeplugs are proven performers on such services as hydrocarbon vapors at 900°F and 600 psi; fluid catalysts at 1125°F and 225 psi; and hydrogen at 900°F and 300 psi. Wedgeplug valves can be supplied in alloy steels as service demands.

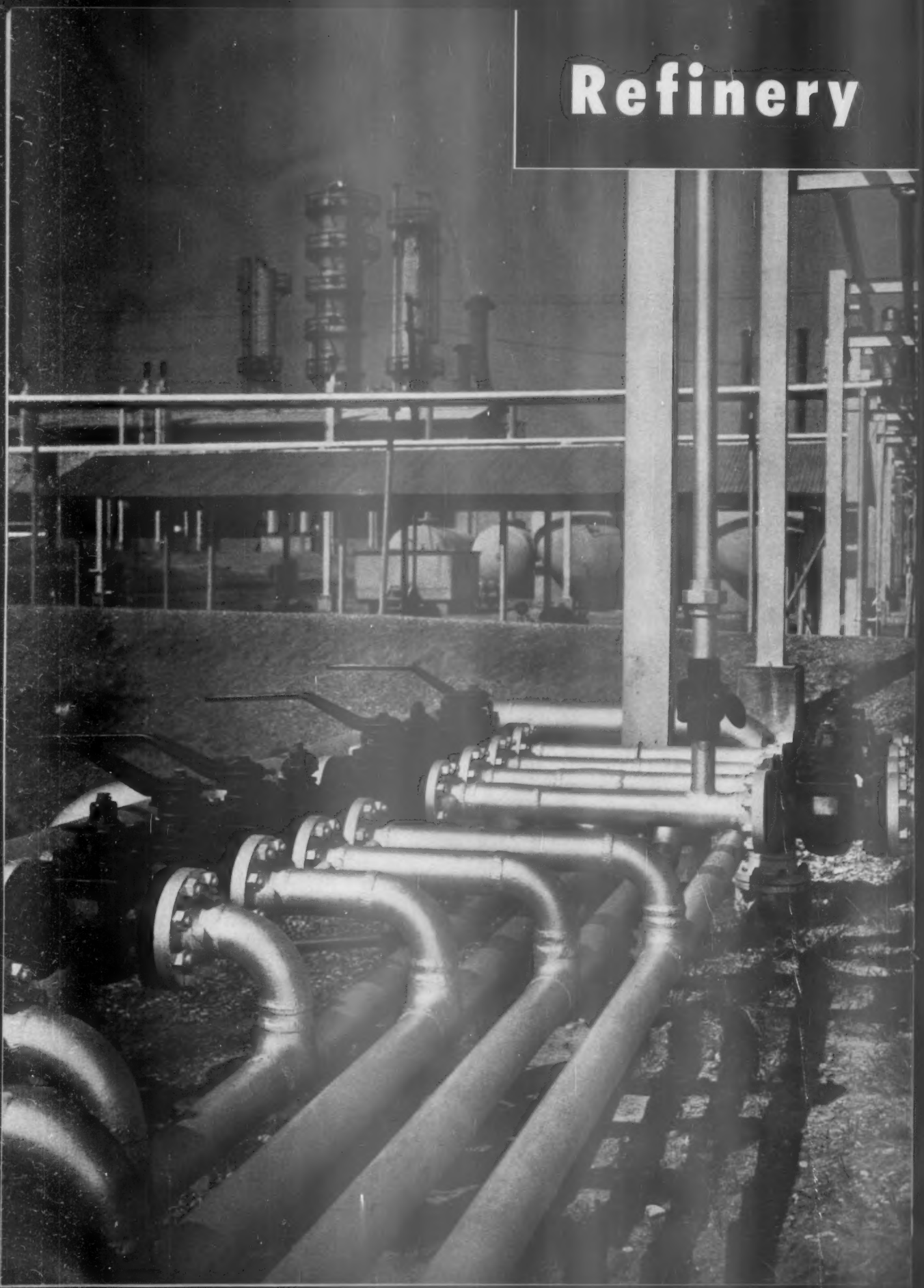
Non-lubricated plug valves • Cast iron, malleable and ductile iron pipe fittings • Bronze, cast iron, ductile iron, cast and forged steel valves

IT PAYS TO BUY QUALITY

For complete information, call your Stockham Distributor or write

WEDGEPLUG VALVE COMPANY
DIVISION OF
STOCKHAM
VALVES *and* FITTINGS

SOLD ONLY THROUGH DISTRIBUTORS


Refinery

Maintenance Made Simple

Here are the quality leaders, the names in refining, natural gasoline and petrochem plant equipment synonymous with performance.

When you specify pipe, valves or welding fittings made by these manufacturers, you know you are getting quality. You know that longer service life and less down time result when quality equipment is installed. We are proud to offer you these quality leaders. We know that the research and development invested in these products mean more satisfied customers for J&L.

You can have up-to-date literature on any of these products by calling your local J&L man.

Specify quality .... and save at J&L.

Jones & Laughlin

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If it's sold by J&L....
It's the best available

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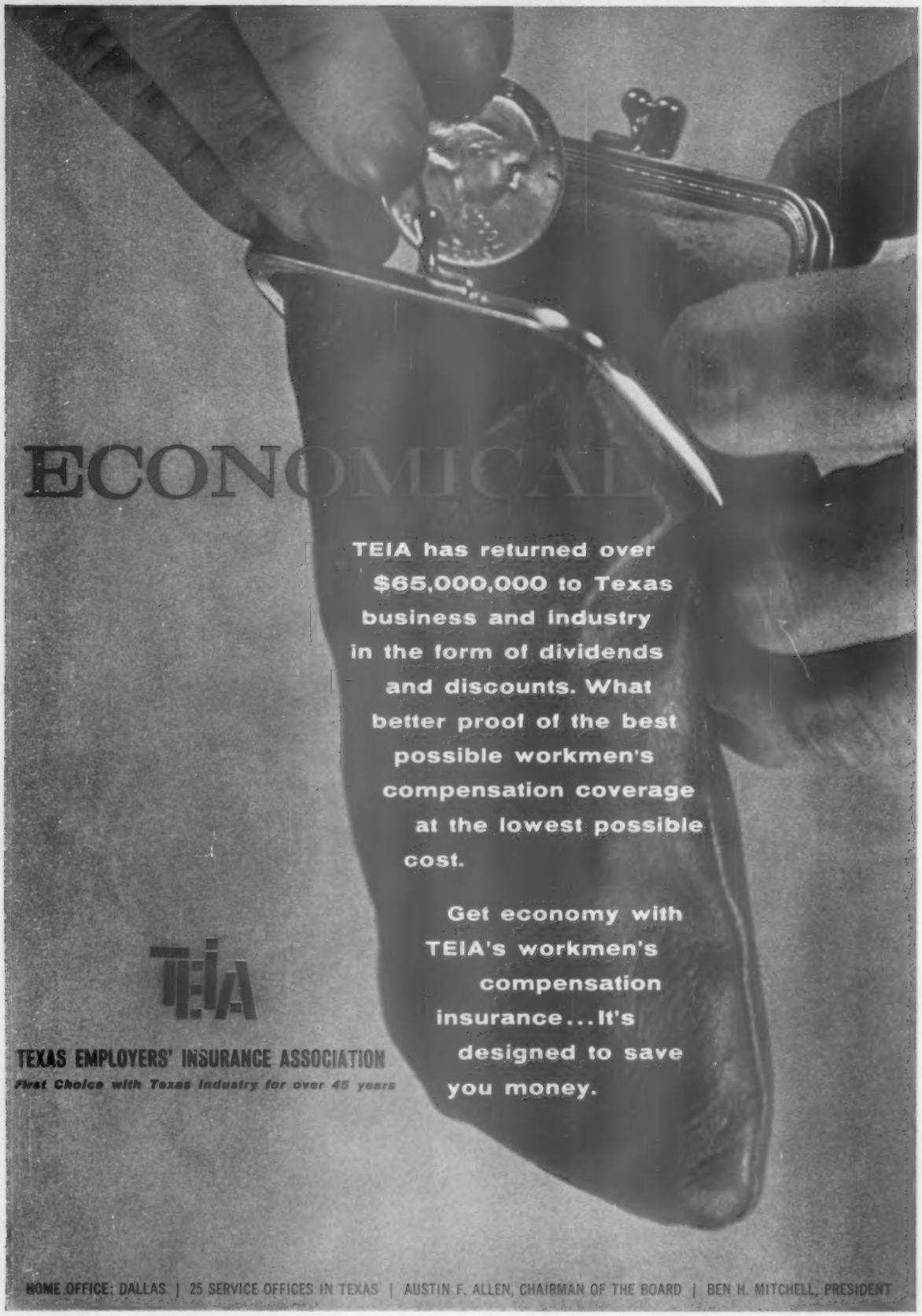
ECONOMICAL
TEIA has returned over $65,000,000 to Texas business and industry in the form of dividends and discounts. What better proof of the best possible workmen's compensation coverage at the lowest possible cost.
Get economy with TEIA's workmen's compensation insurance... It's designed to save you money.
TEIA
TEXAS EMPLOYERS' INSURANCE ASSOCIATION
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HOME OFFICE: DALLAS | 25 SERVICE OFFICES IN TEXAS | AUSTIN F. ALLEN, CHAIRMAN OF THE BOARD | BEN H. MITCHELL, PRESIDENT

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Cut disconnect-reconnect time by as much as 50%

The FALK Spacer Coupling is specially designed for quick installation or removal *without disturbing the driving or driven unit.* This feature can save you up to 50% in disconnect-reconnect time when critical equipment—a process pump, for example—needs repair or replacement.

Here's another saving: with the FALK Spacer Coupling, you can quickly realign shafts *without the usual loss of operating temperature!*

And still another: you can remove or reinstall the FALK Spacer as a unit *without draining the lubricant.*

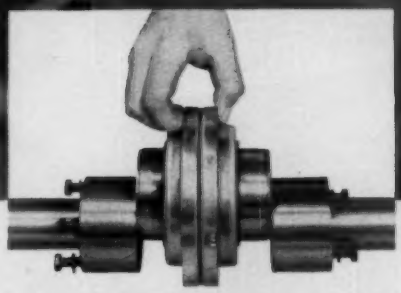
Because of its exclusive grid-groove Steelflex design, the FALK Spacer can accommodate residual misalignment—parallel, angular, or (most important) *both.* Also, it provides torsional resiliency that cushions shock and vibration. Thus it saves wear-and-tear on your connected equipment.

To prove these claims and enjoy these savings, install a FALK Spacer on one application—and see for yourself. Consult your FALK Representative or Authorized Distributor.

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

Representatives and Distributors in many principal cities.

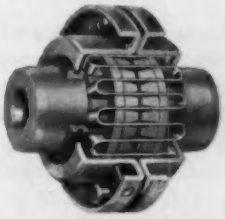


EASY AND QUICK TO INSTALL, DISCONNECT OR RECONNECT

First, mount shaft hubs to allow proper distance between hubs; then, align driving and driven units.

Second, compress Spacer to fit space between hubs and tighten cap screws to pull spacer hubs into the registered fit.

To disconnect, reverse the second step. No draining of lubricant necessary.



The heart of the FALK Spacer ...the basic Type F Steelflex

Write for Service Manual 4838

FALK

...a good name in industry

Macks are the muscles of the oil fields. Here one of Hilderbrandt's B-75 Model Macks loads up for a rugged off-highway run to a remote drilling site. Roadless terrain is taken in stride because Mack oil field trucks are built for oil field work.

MACK
for over 7 straight years
NO.1
by far in sales of diesel trucks

Hardworking oil field Macks

Help smooth drilling operations

Breakdowns or tie-ups have no place in the round-the-clock trucking operations of Hilderbrandt Tank Service, Inc., Lindsay, Oklahoma. On 24-hour call, their vacuum tank trucks must roll on a moment's notice with pressurized loads of drilling mud, frac-oil and other compounds used to smooth the kinks out of oil drilling operations.

Says President Floyd Hilderbrandt, "Oil-field service offers some of the worst off-highway truck operating conditions. We use Macks on these rugged jobs because they outperform any of the other units we operate, give us good economy and work with an absolute minimum of downtime."

When your vehicles must tackle unusually demanding terrain conditions, Macks will perform where other trucks bog down—in mud, loose gravel and sand—thanks to Mack's exclusive Balanced Bogie with Power Divider. It's a four-wheel drive, tandem rear-axle assembly with an inter-axle differential that directs the most power to the wheels having greater traction. The Power Divider allows for differences in speed between wheels, maintains traction in slippery going and preserves true differential action without surging or vibration. Mack-built Thermodyne® engines—gasoline or diesel—are unexcelled for long life, dependability and fuel economy. Mack-built transmissions—available up to 20 speeds—are built to accommodate a variety of power takeoff units.

In oil field service—as in any operation where more is demanded of a truck—you'll get more out of a Mack. Your Mack branch or distributor will be glad to show you why. Mack Trucks, Inc., Plainfield, New Jersey. Mack Trucks of Canada, Ltd., Toronto, Ontario.

7907

MACK
FIRST NAME FOR
TRUCKS

SEALING AGAINST SOLVENTS, CRUDE OIL, CRESOL, GASOLINE...

VITON® PACKINGS UNHARMED BY 2 YEARS' FLUID EXPOSURE

With the reputation that VITON synthetic rubber has built for heat resistance (serviceable at 450° F. and up), engineers sometimes overlook the value of its outstanding performance in contact with fuels, oils, solvents and chemicals. Here is an application* where fluid resistance was the *only* problem . . . and VITON the only answer.

In 1957, General American Transportation Corporation installed a new fluid loading system at its tank farm in Galena Park, Texas. Swivel joints on the system required packings made of rubber. The problem: what rubber could handle crude oil, solvents, gasolines, cresol and sodium cresylate—to mention just a few of the fluids in storage? The answer: Du Pont VITON.

For well over two years, packings made of VITON, Du Pont's new fluoroelastomer, have been used in General American's tank car loading system to handle more than 80 different fluids. A recent visual inspection revealed no swelling, no deterioration and not a trace of product leakage. What's more, every packing originally installed (72 in all) is still in service.

• • •

Outstanding resistance to oils, fuels, solvents and chemicals, as well as to elevated temperatures, has helped VITON improve performance of refinery valves, heat exchangers, pumps and a wide range of industrial equipment. Write for specific data on the heat and fluid resistance of this new elastomer. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department OG-10, Wilmington 98, Delaware.

*This case history from the ELASTOMERS NOTEBOOK—subscription free on request.

PROPERTIES OF VITON

Hardness Range	60-95 Shore A
Tensile Strength	Over 2,000 psi.
Temperature Range	—40° F. to 600° F.
Chemical Resistance	Excellent
Oil Resistance	Excellent
Compression Set Resistance	Very Good
Ozone Resistance	Outstanding
Flame Resistance	Good
Sunlight and Weather Resistance	Very Good
Abrasion Resistance	Good

DU PONT
REG. U. S. PAT. OFF.

SYNTHETIC RUBBER
NEOPRENE HYPALON® VITON® ADIPRENE®

Better Things for Better Living . . . *through Chemistry*

NOW... select flexible couplings by SHAFT SIZES

new
shaft-rated

DIAMOND *hi-Cap* *

TM

COUPLINGS
give you

- lower cost
- bearing and shaft protection
- quick, easy selection and installation

*** *Hi-Cap* means HIGH CAPACITY**
All working parts are heat treated steel, and hardened to provide greater resistance to wear, longer service life.

◆ DIAMOND *Hi-Cap* couplings are available in Finished-Bore and Taper-Lock to accommodate any shaft diameter combination from ⅛" to 6⅛". New *Hi-Cap* Bulletin No. 1060-C gives construction details, specifications and prices. WRITE TODAY!

DIAMOND CHAIN COMPANY, INC.
A Subsidiary of American Steel Foundries
Dept. 475, 402 Kentucky Ave., Indianapolis 7, Indiana
Offices and Distributors in All Principal Cities

DIAMOND ROLLER CHAINS

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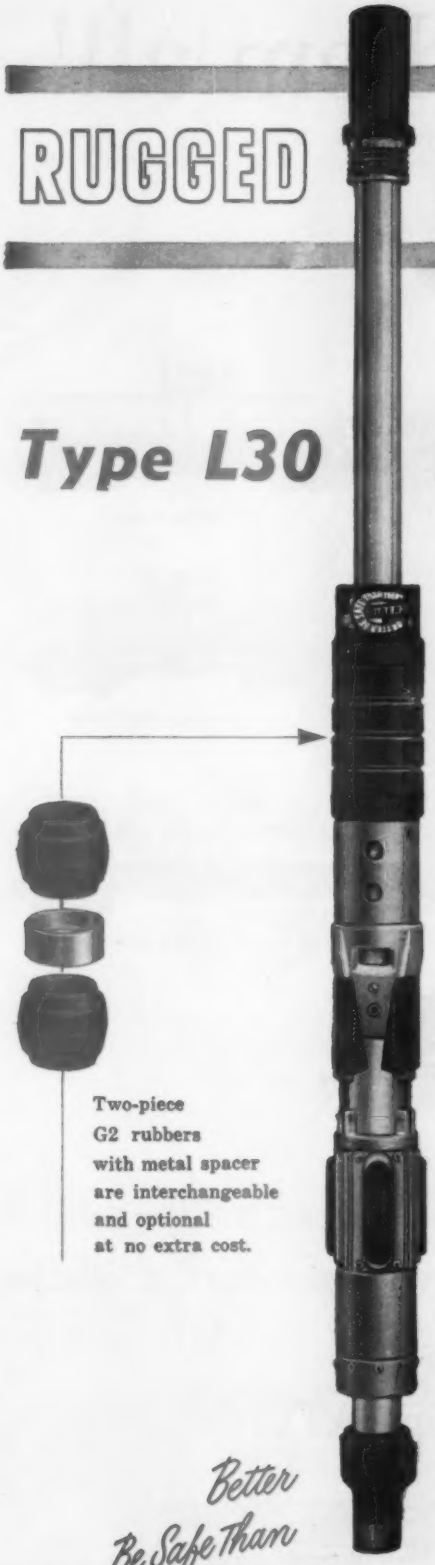
RUGGED AND RELIABLE

GUIBERSON'S

Type L30 Deep Well Packer



Two-piece G2 rubbers with metal spacer are interchangeable and optional at no extra cost.

For deep well work with high temperatures and pressures, use Guiberson's dependable L30 Packer. It will give you long valve travel (30 inches) with minimum overall length at no extra cost. You can pull the L30 surely and safely. The fast-action automatic latch, protected by a positive anti-lock device that assures ready release, snaps easily into latched position. Tough, long-wearing friction pads supply ample drag. Packing rubbers of advanced design will not vulcanize to the casing wall. All these features are available on the L30 or the L8 with 8" valve stroke in a wide range of casing sizes. For circulating *above* the packer, Type L30P or L8P with perforated mandrel is available.

Better Be Safe Than Sorry

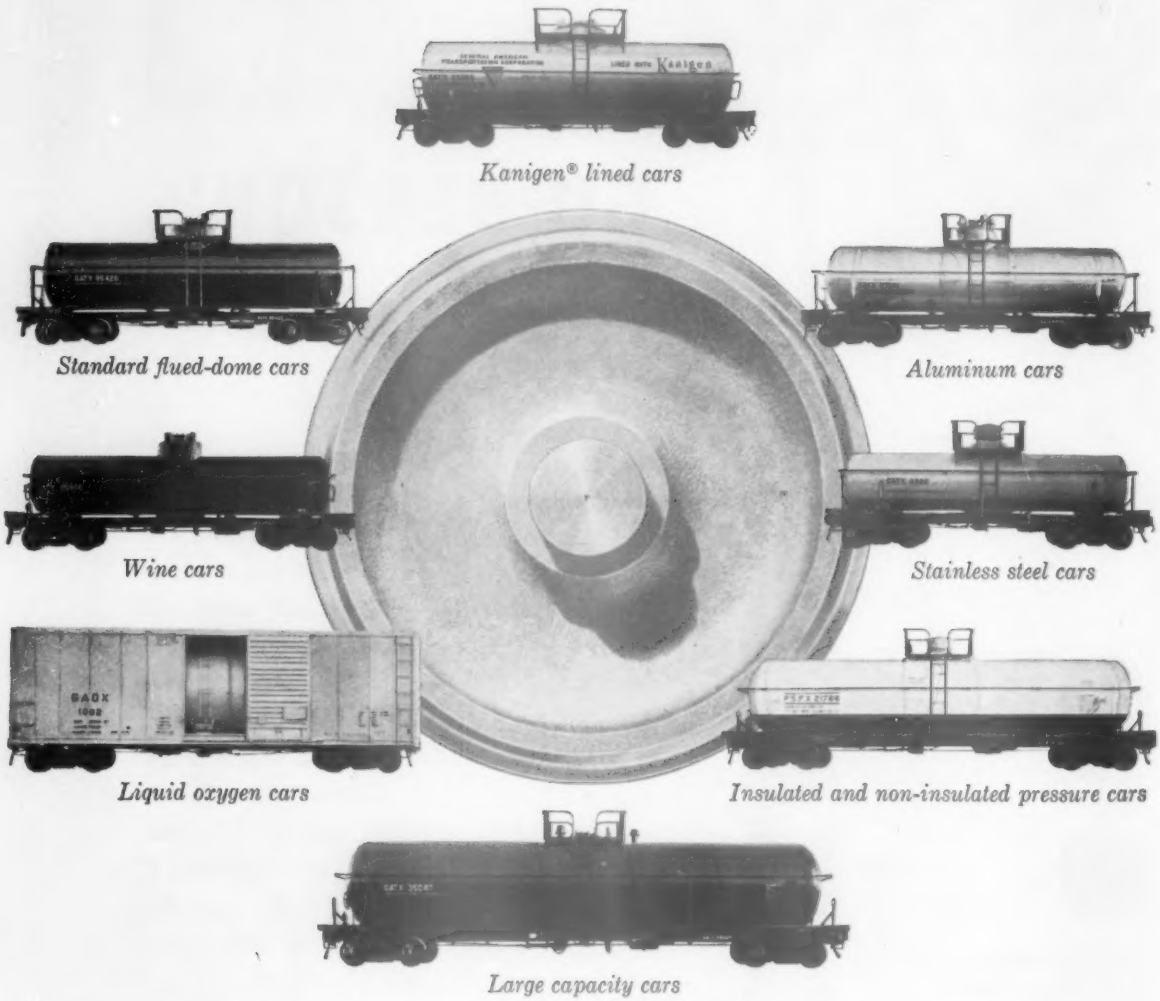
BETTER BE SAFE THAN SORRY GUIBERSON

THE GUIBERSON CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

Sold by Oil Field Supply Stores Everywhere

GATX builds them all!



Kanigen® lined cars

Standard flued-dome cars

Aluminum cars

Wine cars

Stainless steel cars

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Insulated and non-insulated pressure cars

Large capacity cars

If your product is a liquid, GATX builds—or can build—a tank car to transport it; maintains a nation-wide network of shops for service and upkeep.

No capital investment . . . when you ship GATX!

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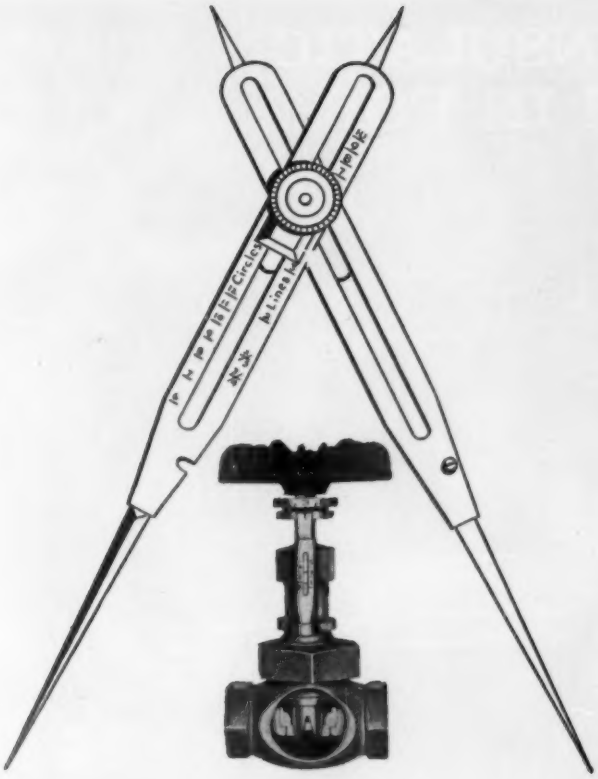


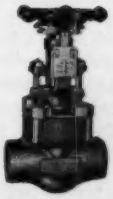
PROPORTIONER

controls flow to save for you

The V-port disc in all Hancock "Flocontrol" Valves insures proportional flow throughout the entire lift of the stem. They are valves that help you achieve uniform product quality through closer control, save steam and fuel on process work, and cut maintenance costs.

"3 in 1" valve design combines variable orifice with shut-off and micrometer dial and pointer. The valve opening can be set within 1/10 turn of the handwheel —you can duplicate all settings easily, instantly. No shut-off valve required—flow is in a straight line, with separate shut-off seating surface located away from the V-ports.

Hancock "Flocontrol" Valves are available in Bronze and Steel to meet the most demanding services. Ask your industrial supply distributor for details.



Hancock "Flocontrol" valves assure positive pinpoint control—eliminate all guesswork.

MANNING MAXWELL & MOORE INC. TRADE MARK

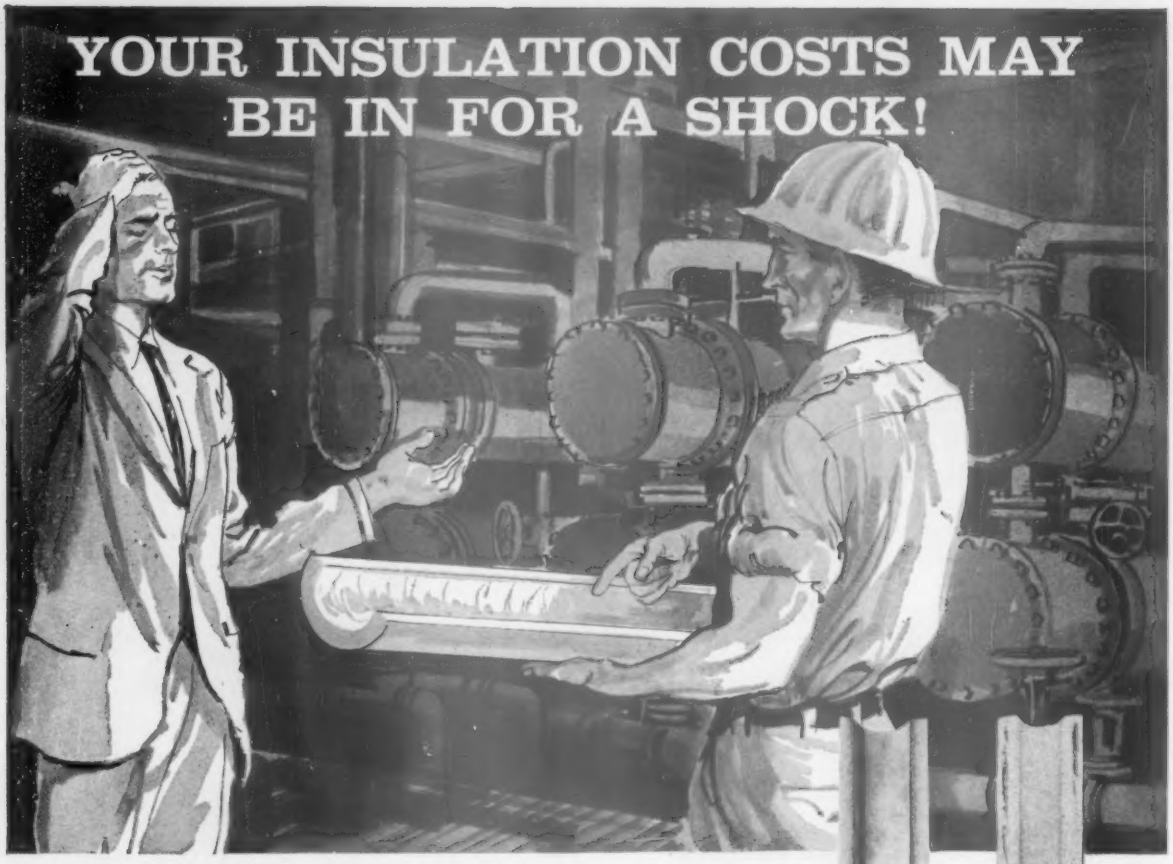
HANCOCK "FLOCONTROL" VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Valve Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

YOUR INSULATION COSTS MAY BE IN FOR A SHOCK!



use Unibestos to eliminate thermal shock effects

Insulation that looks perfectly intact on the outside is sometimes a maze of cracks on the inside. That's when your operating costs, in the form of *heat losses*, begin sailing off into thin air. And it's thermal shock effects like this that can put the real shocker on your operating costs.

But you won't find thermal shock effects in any section of Unibestos insulation. Unibestos defies thermal shock, fumes, acids and moisture; resists impact and rough handling; eliminates shrinkage; cuts application time and costs; and guarantees real insulating efficiency. That's why it's worth more. Yet it continues to sell at competitive prices.

Available in full range of standard pipe sizes and thicknesses. Single thicknesses to five inches. Specials to 44" O.D. in half sections.

Write today, on your letterhead, for Bulletin No. 65610.

UNIBESTOS AMOSITE INSULATION 900° F.

EFFECTS OF THERMAL SHOCK

Exclusive use of extra long ***Amosite*** asbestos is your positive assurance that Unibestos insulation has the mechanical qualities that prevent thermal shock effects. Guaranteed up to 1200° F, Unibestos has been known to withstand temperatures as high as 2000° F, without thermal shock effects.

UNIBESTOS

worth more, yet sold at competitive prices

UNARCO ®

UNARCO PRODUCTS

• UNIBESTOS, Amosite Asbestos Pipe Covering and Block • Calcium Silicate Pipe Covering and Block • 85% Magnesia Pipe Covering and Block • Mineral Fiber Block • Wrap-On Insulation • Lace-On Insulation • Turbine Blankets • Insulating and Finishing Cements • Asbestos Textiles • Packing and Gasketing.

UNION ASBESTOS AND RUBBER COMPANY • FIBROUS PRODUCTS DIVISION

DEPT. 240, Bloomington, Illinois

Compactness of Super HC High Capacity V-Belt Drive was major factor in choice—saving of $33.75 was 'bonus'.

A product of Well Drilling Equipment Manufacturing, this truck rig with permanently mounted Gardner-Denver Mud Pump used in conjunction with Scott-Hycalog Power Swivel can be run right up to the job and be working in a matter of minutes.

with new High Capacity Drives

rig manufacturer SAVES

43% drive space
223 pounds drive weight
$33.75 drive cost

on each unit!

Conventional drives used on truck-mounted mud-pump rigs produced by Well Drilling Equipment Manufacturing, Inc., of Clare, Michigan, presented a problem: sheaves were too wide and too large in diameter to keep rig as compact as its designers wanted it to be.

Paul Scott, the company's President, considered other possibilities and finally chose Gates Super HC High Capacity V-Belt Drive to transmit power to the Gardner-Denver Mud Pump incorporated on each rig.

Result: face width of sheaves was not only reduced to 5-13/16 inches, a saving of 43% in space, but total drive weight was cut by 223 pounds, a saving of 48%! And a bonus was realized—the Super HC High Capacity Drive cost $33.75 LESS than the former drive.

Mr. Scott reports that, after seven months on their rigs in the field, Super HC High Capacity Drives have withstood all shock loads, with no maintenance whatsoever—and praises them further for "economy, pulling power, ease of assembly, appearance and compactness."

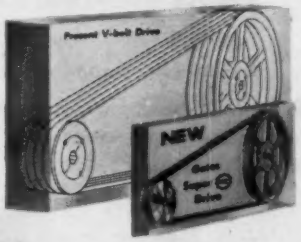
Stocks and Technical Assistance Available

Stocks of Gates Super HC High Capacity V-Belts and V-Belt Drives are located in all principal industrial centers—where you will also find a Gates Office or Gates Distributor ready to help you with any power-transmission problem involving drives. Look for them in the Yellow Pages of your phone book. Ask for Booklet: *The Modern Way to Design Multiple V-Belt Drives.*

The Gates Rubber Company, Denver, Colorado
Gates Rubber of Canada Ltd., Brantford, Ontario

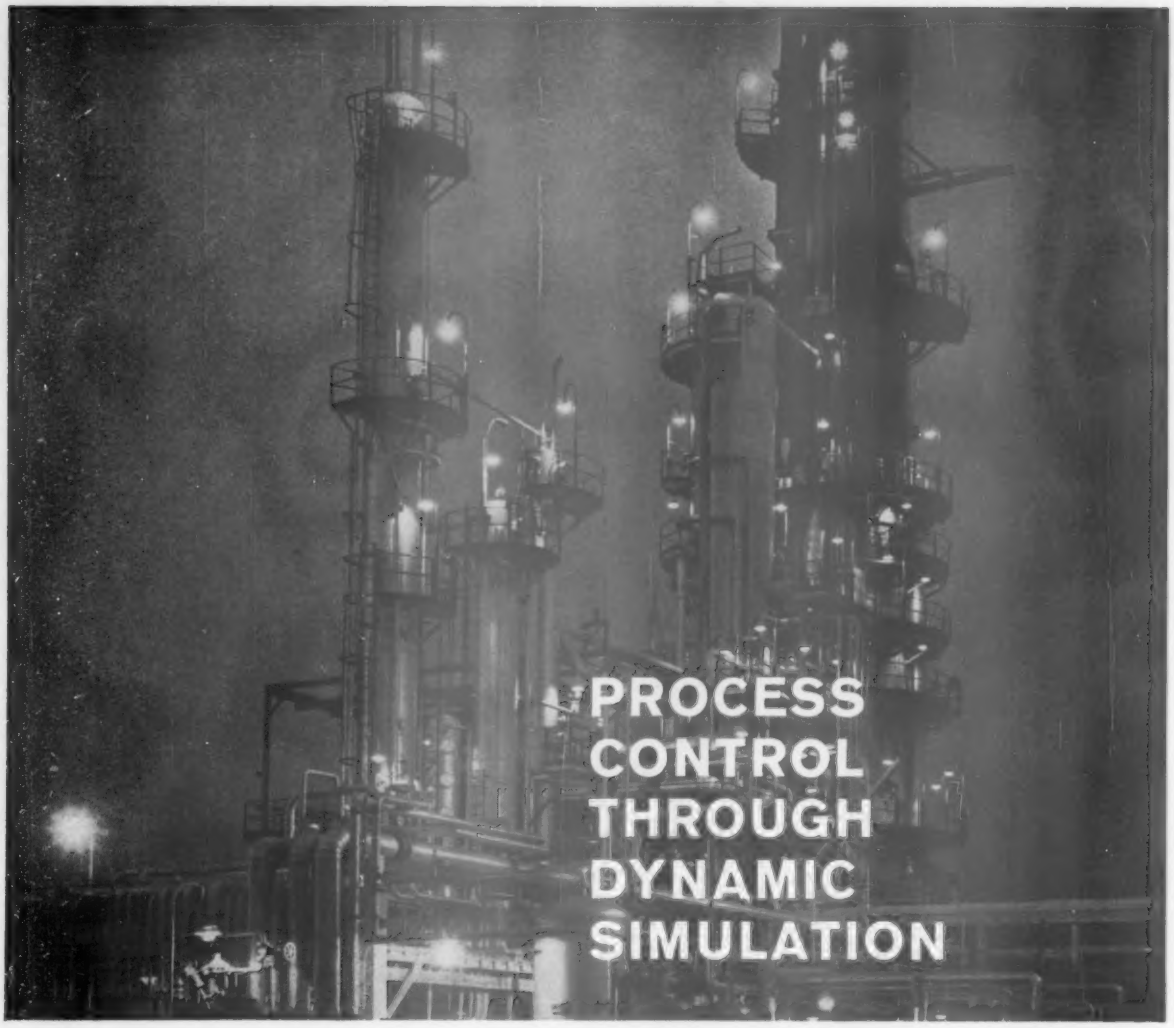
Gates — The Mark of Specialized Research

TPA546



Gates Super HC HIGH CAPACITY V-Belt Drives

same hp capacity in smaller "package"



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They Say—

Whither the by-product?

"The hearings of the Alberta Oil and Gas Conservation Board dealing with applications from companies wishing to construct gathering and distribution systems within the province for natural gas by-products, point up the beginning of a new phase in the development of our petroleum industry.

"In the first phase the emphasis was on crude oil. The second, hinging on the approval of natural-gas export, is not yet into its full stride. But it has already raised questions regarding the third phase: the disposition of what are classed as natural gas by-products: sulfur, condensates, and liquefied petroleum gases.

"We suspect that in general it will be found uneconomical to produce gas if the by-products cannot be sold, but must be returned to the ground. In any event, this approach to the disposal problem makes little economic sense. The logical answer is to find markets for the by-products. But where?

"Economic realism pretty well narrows the field down to the two markets discussed during the Conservation Board hearings: oil refineries in Alberta and other parts of Canada; and U. S. markets, notably in the Chicago area.

"In considering the relative merits of these markets the board and the provincial government will be called upon to make significant policy decision . . . We are not dealing with a temporary situation, but with matters which will have a long-term impact on the petroleum industry and the provincial economy."

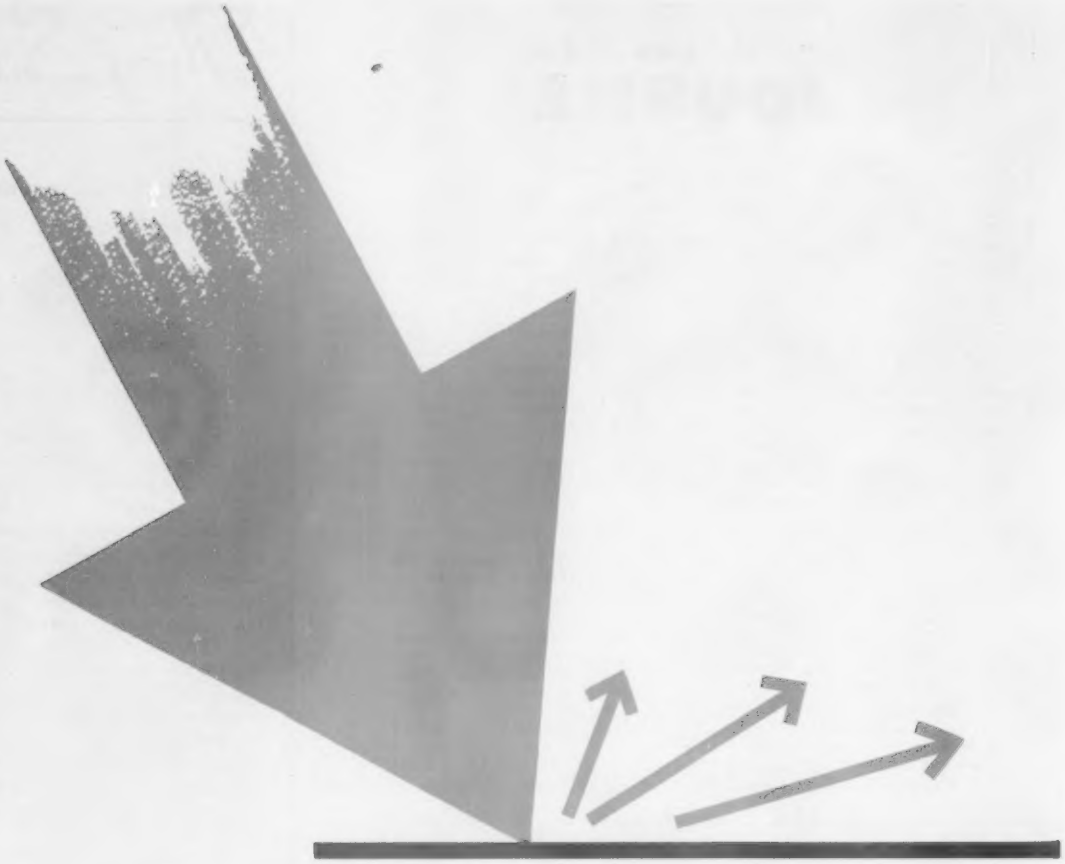
—*Editorial in the Calgary Albertan.*

Problem of asphalt quality

Dear Sir:

Your Oil and Gas Journal of September 19 carrying the excellent article on asphalt quality by D. W. Gagle (p. 121) is a most timely contribution to this subject. Gagle gives a good resume of some of the obsolete test methods which are still being used but should long since have been abandoned.

The tests enumerated by Mr. Gagle are physical tests and require to be expressed numerically before one can judge asphalt quality. Also, a mere comparison of viscosities before and



Metallurgical Phenomena... and the metals to cope with them.

These are the stock-in-trade of the Lukens Application Engineer—whether the problem be one of abrasive impact (symbolized above) or corrosion or pressure or structural stress or high and low temperature. Investigation of the best steels for "problem" applications has been carried on for years by the Lukens Application Research team. We would welcome the opportunity to contribute the results of this research to your own design knowledge. Please contact us in your early design stages. Call collect: Joe Proctor, Manager of Application Engineering, Extension 422, Lukens Steel Company, Coatesville, Pennsylvania.

HELPING INDUSTRY CHOOSE STEELS THAT FIT THE JOB

after hardening relates to "durability." Here, as in other asphalt tests, minimum and maximum limits must be stated in any comprehensive specification. As stated by Lord Kelvin years ago, until you can count or give a number value to physical phenomena, you know nothing.

What is required today is for the paving engineer to state in absolute units, in an entirely new kind of modern specifications, the type and quality of asphalt he wants and he knows will do the job. A rheologist should be a part of every highway department.

The vague ideas prevailing today as to what constitutes a good adhesive should be clarified and included in the tests and specifications.

In asphalt-engineering applications, the consumer is employing a colloidal organic material and it must be described and specified from that standpoint. All the many rheological properties of asphalts in discussion today are dependent on the colloidal state of the asphalt.

The refiner stands ready to supply basic information on asphalts and to manufacture the proper g r a d e and quality once it is described in a set of meaningful specifications. Before this can be done an immense amount of work needs to be carried out in basic and applied asphalt laboratories.

The whole objective of such programs is to discard obsolete tests, such as specific gravity and flash point, and bring loose ends together in a real effort to give sense to the term "quality."

Edwin J. Barth
Asphalt Consultant
New York

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

OCTOBER

23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

24-25 American Society of Mechanical Engineers, American Institute of Electrical Engineers, fuels conference, Daniel Boone Hotel, Charleston, W. Va.

25-28 National Association of Corrosion Engineers, south central region conference, Mayo Hotel, Tulsa.

26-27 Armour Research Foundation of Illinois Institute of Technology, computer applications symposium, Morrison Hotel, Chicago.

26-27 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28 N a t u r a l Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

28 American Institute of Chemical En-

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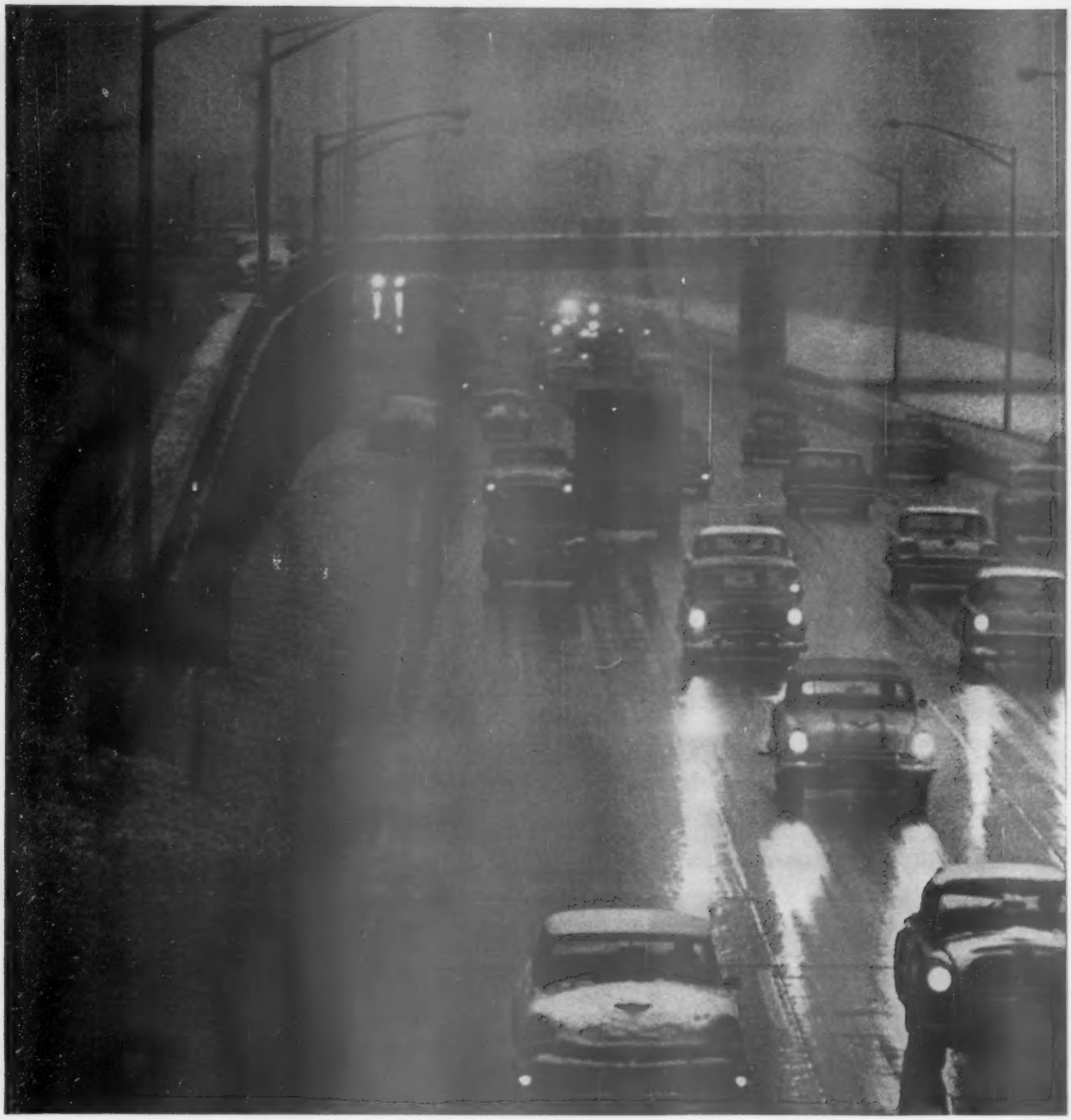

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Armour's **Duomeen**® compounds have been used successfully by major oil refiners the past several years to prevent carburetor icing. These anti-stalling additives are so effective that they are used on a ppm basis . . . amounts so small your costs are reduced to a fraction of what you pay for protection gained by the use of freezing-point depressants.

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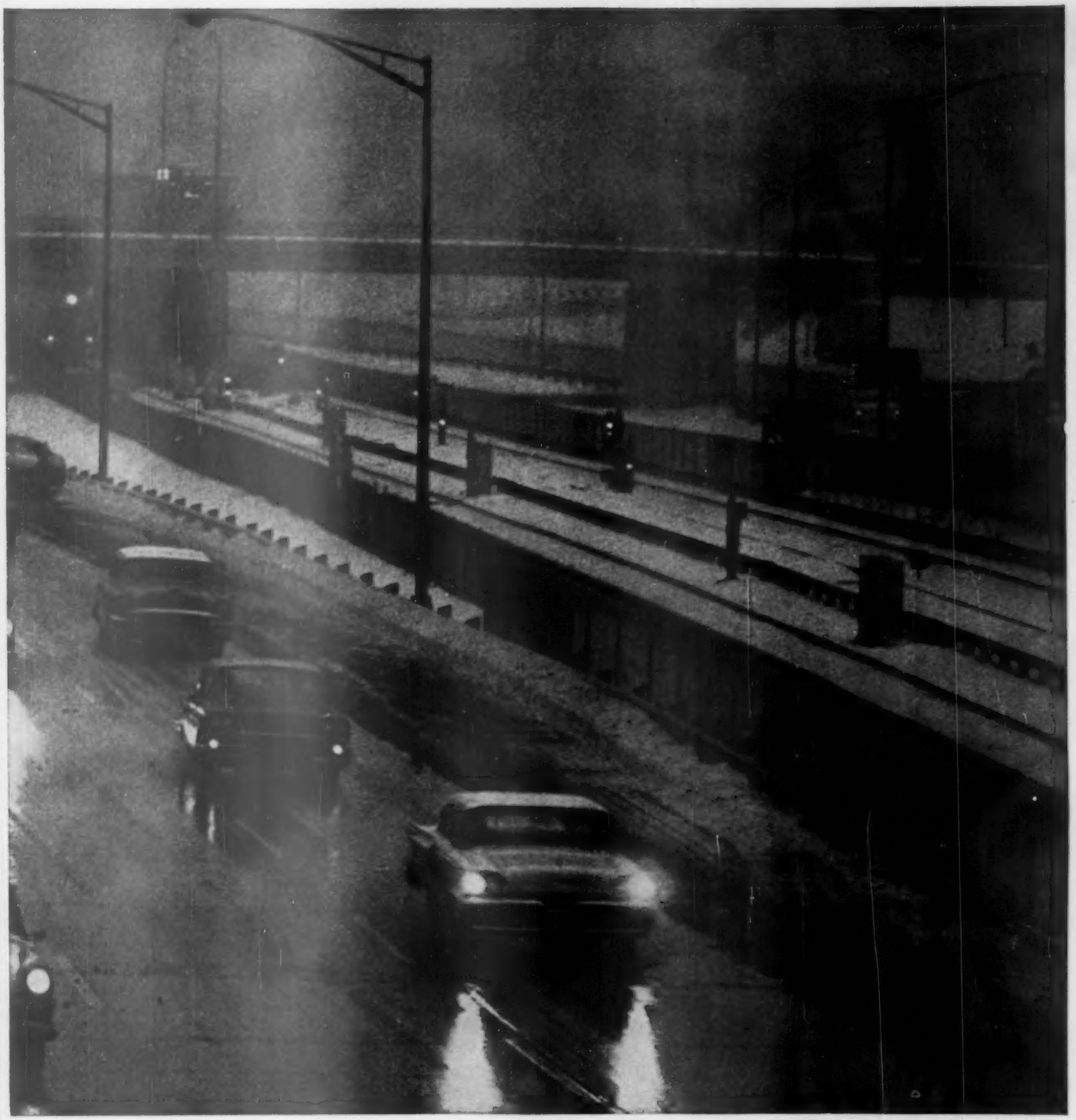

KEEP 'EM ROLLING AT LESS COST

erties and economies of these Armour additives over freezing-point depressants.

Armour also makes a wide variety of chemicals as specialized additives for automotive uses. These polar nitrogen compounds have a broad range of use. In addition to preventing corrosion in greases, lube oils and gasolines, these compounds also improve lubricity in lubricating oils, transmission fluids and greases.

To learn more about Armour's gasoline anti-stalling additives and other refined product additives, and to receive samples of them, write to:

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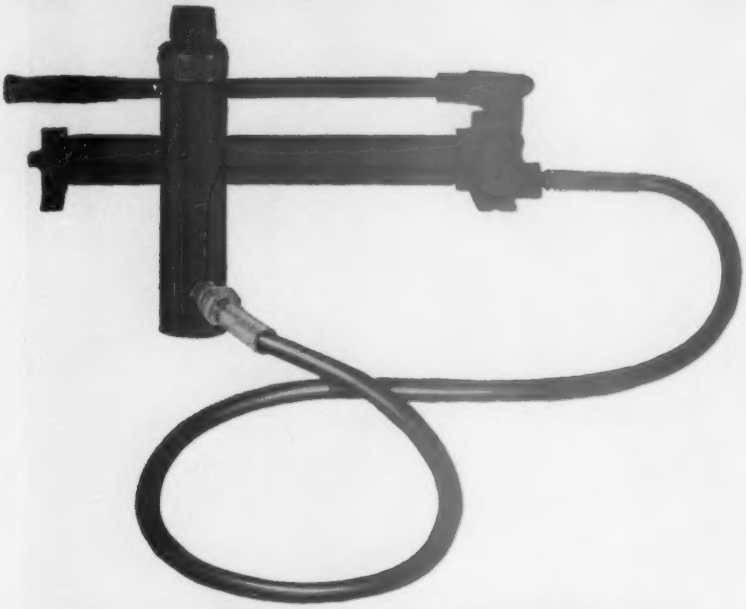

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gineers, South Texas section annual technical meeting, Rice Hotel, Houston.

31-Nov. 4 University of Oklahoma, petroleum land men's institute, Student Union Building, University of Oklahoma, Norman.

NOVEMBER

3 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.

3-4 American Association of Petroleum Geologists, Pacific section, annual meeting, Ambassador Hotel, Los Angeles.

3-4 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-9 Chemical Institute of Canada, chemical engineering division, conference, Quebec City.

7-10 Society of Exploration Geophysicists, international meeting, Moody Convention Center, Galveston, Tex.

14-16 American Petroleum Institute, fortieth annual meeting, Conrad Hilton, Palmer House and Congress hotels, Chicago.

14-16 Society of Petroleum Engineers of AIME, Venezuelan sections, fourth annual meeting, Maracaibo, Venezuela.

15-16 University of Kansas, natural-gas pipeline institute, Courthouse, Liberal, Kans.

15-16 Purdue University, symposium on engineering applications of random function theory and probability, West Lafayette, Ind.

15-17 Southwest Research Institute, Air Force, Navy, industry propulsion systems lubrications conference, Hilton Hotel, San Antonio, Tex.

18 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

18-20 Roswell, N. M., Geological Society, field trip, San Andres and North Franklin Mountains, registration November 17, Las Cruces, N. M.

20-22 Fluid Controls Institute, Inc., fall meeting, Drake Hotel, Chicago.

22 Manufacturing Chemists' Association, tenth semiannual meeting and midyear conference, Statler Hilton Hotel, New York City.

27-Dec. 2 American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York City.

DECEMBER

1-3 American Chemical Society, southwest regional meeting, Biltmore Hotel, Oklahoma City.

4-7 American Institute of Chemical Engineers, meeting, Statler Hotel, Washington.

5-7 Interstate Oil Compact Commission, annual meeting, Westward Ho Hotel, Phoenix.

9 Tulane University, School of Law, and American Association of Oilwell Drilling Contractors, fifth annual program on mineral and tidelands law, University Center, Tulane University, New Orleans.

26-31 American Association for the Advancement of Science, annual meeting, New York City.

JANUARY

15-18 Pipe Line Contractors Association, annual meeting, Mark Hopkins and Fairmont Hotels, San Francisco.

16-19 Instrument Society of America, winter instrument-automation conference

NO "NEW IMAGE" FOR US, THANKS

Seems nowadays practically everyone talks about "changing the image," "creating a new corporate image" or "giving the product a more dynamic image."

There's no such talk around Jenkins Bros.

When it comes to valves, we're as modern as tomorrow! But when it comes to a new corporate image, no thanks. Not for us. Our corporate image is nearly 100 years old, and it still suits us just fine. Here's why:

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"A Fair Offer" was first published in 1869. Simple and forthright, it said that Jenkins Bros. wanted Jenkins Valves to be judged on performance. But — and this made the difference — not on performance in the average application, but rather in the very toughest one. Note that phrase, "the worst place you can find."

To us, it just naturally figures that the product which asks for the hardest job, will also be better, longer lasting and more trouble-free in regular, run-of-the-mill applications. Makes sense, doesn't it?

At intervals we republish "A Fair Offer" just because it does make sense to so many of our customers and friends. It's a useful reminder that products may change but *high standards* never go out of style.

JENKINS

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Jenkins Bros

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17-19 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville.

20 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

FEBRUARY

7-8 University of Oklahoma, School of Petroleum Engineering, advanced petroleum engineer seminar, University of Oklahoma, Norman.

18 Purdue University, business history conference, "Management Decisions Under Government Regulation," Memorial Union, Purdue University, Lafayette, Ind.

24 Natural Gasoline Association of America, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette, La.

26-Mar. 1 American Institute of Chemical Engineers, petrochemical and refining exposition, Municipal Auditorium, New Orleans.

26-Mar. 2 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Chase and Park Plaza Hotels, St. Louis.

MARCH

7-8 University of Oklahoma, School of Geological Engineering seventh biennial geological symposium, Student Union Building, University of Oklahoma, Norman.

8-10 American Petroleum Institute, Division of Production, southern district meeting, Captain Shreve and Washington-Youree hotels, Shreveport, La.

13-17 National Association of Corrosion Engineers, annual meeting and corrosion show, Hotel Statler, Buffalo, N. Y.

15-17 Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas.

22-24 American Petroleum Institute, Division of Production, southwestern district meeting, Cole Hotel, Albuquerque.

23 National Industrial Conference Board, general session, Shamrock-Hilton Hotel, Houston.

27-29 Midwest Gas Association, annual meeting and convention, Sheraton-Fontenelle Hotel, Omaha.

28-29 University of Oklahoma, Schools of Petroleum and Gas Engineering, gas conditioning short course, Oklahoma Memorial Union Building, University of Oklahoma, Norman.

APRIL

5-7 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Mayo Hotel, Tulsa.

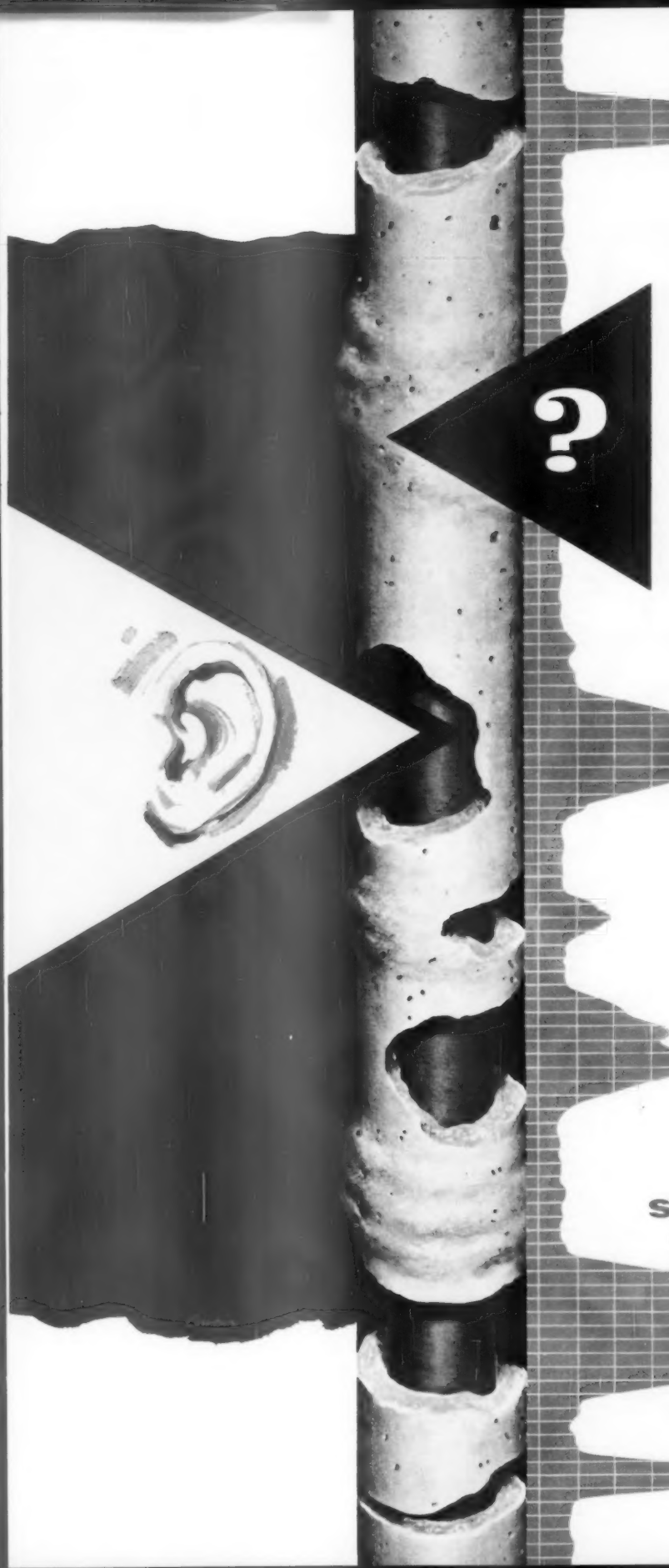
6-7 University of Oklahoma, School of Mechanical Engineering, short course on industrial engines, University of Oklahoma, Norman.

9-12 Western Petroleum Refiners Association, annual meeting, San Antonio, Tex.

18-20 University of Oklahoma, southwestern gas measurement short course, North Campus, University of Oklahoma, Norman.

19-21 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

20-21 Society of Petroleum Engineers of AIME, East Texas-Louisiana-Arkansas gas-technology symposium, Tyler, Tex.



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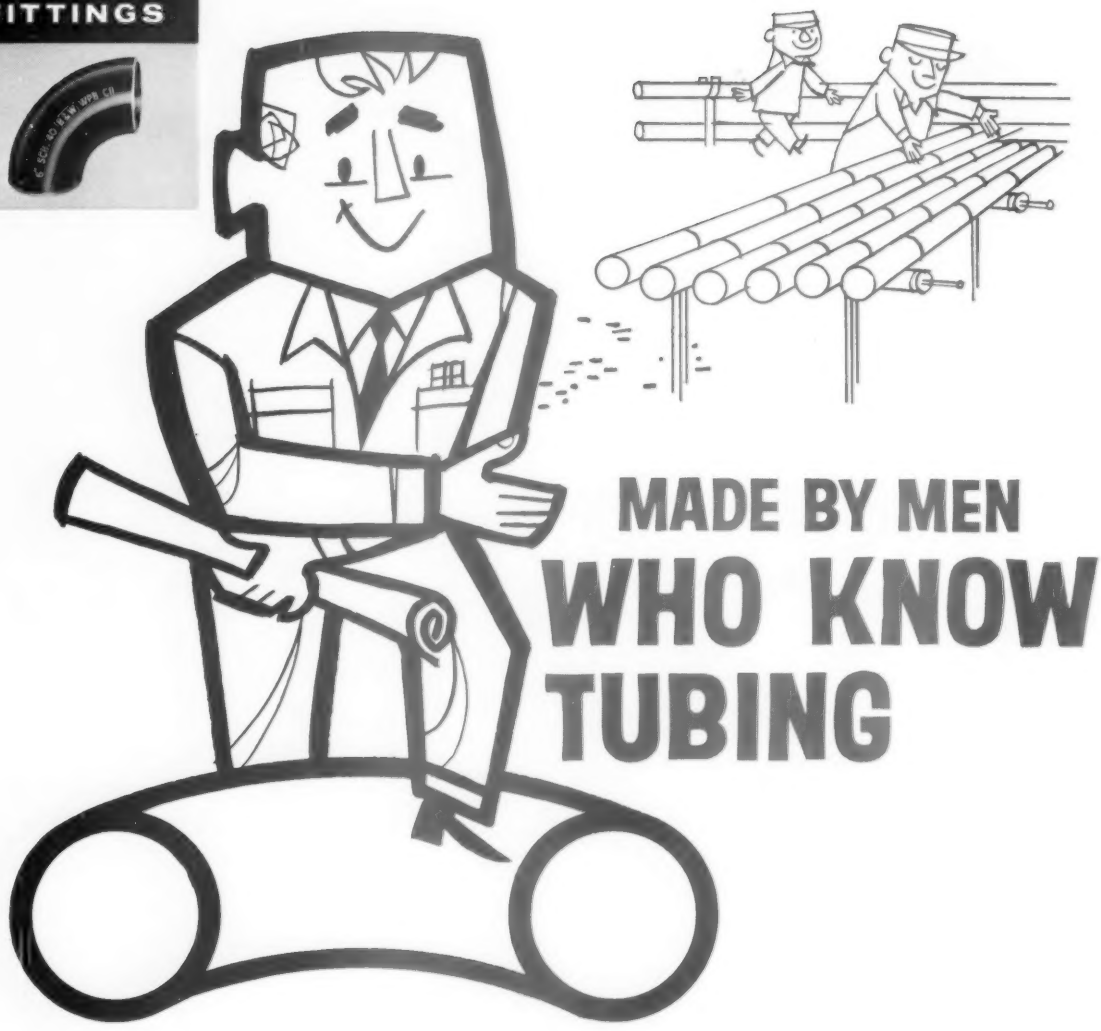

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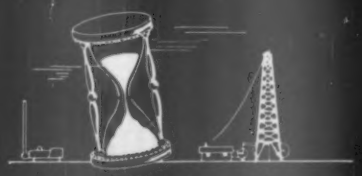


the Journal said...

50 years ago

October 27, 1910

The old Lucesco refinery, a petroleum landmark at Kiskiminetas Junction on the Allegheny division of the Pennsylvania Railroad, is being dismantled. It is one of the oldest and largest plants in the United States for the manufacture of illuminating oil. Originally, it operated with coal but was converted to the use of petroleum.

The Frisco Railroad is joining the Santa Fe system in starting to convert its locomotives from coal to oil burners. The Frisco will convert all locomotives on its Oklahoma City and Sapulpa divisions through Oklahoma. The Santa Fe is converting all its Kansas locomotives.

More than 25 American and English oil companies have entered the booming oil play in Mexico's Tampico district, embracing an area extending 75 miles down and back from the Gulf Coast.

25 years ago

October 24, 1935

Famous patent infringement case of Universal Oil Products Co. against Root Refining Co. is closed after 10 years of litigation. United States Supreme Court refuses to review decisions of lower courts holding that Universal's patents covering "clean circulation" and "multiple-coil" cracking were infringed.

World's deepest test finally is completed after 3 years of drilling, testing, plugging back, shooting, acidizing, perforating, and retesting. Gulf Production Co. makes 175-bbl. pumper at 2,900 ft. in its depth-record-breaking 103 McElroy test, drilled to 12,786 ft., in Upton County, West Texas.

10 years ago

October 26, 1950

Service Pipe Line Co., affiliate of Standard Oil Co. (Ind.), formally opens its new six-story office building in downtown Tulsa. It is the only building in the world designed and constructed specifically as the operating headquarters of a pipeline system, and the first to be owned and occupied entirely by a major pipeline company.

Interstate Oil Pipe Line Co. announces it will move its corporate headquarters and executive departments from Tulsa to Shreveport, because of its larger activities in Louisiana and Mississippi. Transfer to be completed by next July.

Special dedicatory ceremonies mark completion of Sinclair Oil & Refining Co.'s new 35,000-bbl. refinery at Puerto La Cruz, Venezuela, opened 3 months ahead of schedule.

JOURNALLY SPEAKING

Help wanted

THAT WIGGLY LINE on the graph may be an indication that jobs for technically trained men in the petroleum industry are increasing.

It records the number of inches of help-wanted classified advertising carried in The Oil and Gas Journal during the past 2 years, averaged on a monthly basis.

Offhand you might conclude that such data could indicate nothing more than the health of our classified section and that it's too slim a base to be an index of industry employment conditions.

But there is good authority for believing that it is significant. That authority is the National Industrial Conference Board, a respected economic research outfit.

For several years the board has been making a study of help-wanted ads in metropolitan newspapers and has concluded that the volume of these ads is a valuable indicator of business conditions and trends. In fact, the board is now publishing a help-wanted index on a regular basis.

It discovered some rather tricky things about its help-wanted index. The ad linage is highest when business is booming and jobs are plentiful, and lowest when things are dull and people are out scouting for jobs. This is to be expected.

But the peaks and valleys of the board's help-wanted index are much more extreme than its index of the actual civilian employment rate. So the volume of help-wanted ads exaggerates the actual number of jobs available at both the top and the bottom of a business cycle.

The most interesting thing, however, is that during the last two recessions the volume of help-wanted ads started going down 2 or 3 months before employment began to fall, and it went down faster and farther. But during the upswings the reverse was true. The employment rate picked up sooner and faster than the help-wanted ad volume.

Now to get back to our own figures. If the relationships between the Journal's classified section and the oil industry's employment are the same as the Conference Board found between newspaper help-wanted ads and general employment, it can be concluded that the worst is over and that technical men of the types recruited through our columns are finding new jobs in increasing numbers.

The theory is that companies advertise for help only when applicants quit knocking on their doors in big numbers. So when our help-wanted volume goes up it indicates that at least certain types of positions in the oil business are already begging for people to fill them.

Notice that during August and September we carried twice as many inches of help-wanted ads as we did during June and July. That doesn't necessarily mean that the industry's hiring rate doubled in this period, but it does seem to indicate that personnel managers are having twice as much trouble filling vacancies as they had in the summer.

Now maybe you think all this is nothing but a plug to follow our classified section regularly. Well, in a way it is. You'd be surprised what you can find there at times.

—Henry D. Ralph

PROFITS WITH DOWELL STIMULATION SERVICES

THE STORY AT A GLANCE

- Location — **Eastern Kansas**
- Operated by — **an independent producer**
- Field had been abandoned before waterflood started
- Number of fracture treatments — **34**
- Cumulative production from fractured wells* — **866,512 barrels**
- Cost of fracturing* — **$25,828**
- Fracturing cost per barrel of oil — **3 cents**
- Fracturing cost as a percentage of total production cost — **less than two per cent**

*to December 31, 1959.

the end of 1959, 34 frac jobs had been performed at a total cost of approximately $25,828. All but a few of the earlier jobs were performed by Dowell.

Fracturing fluids, sizes of jobs and techniques were modernized and improved, as the program continued, to assure the operator of the greatest possible return on his investment.

Cumulative production from these wells totaled 866,512 barrels by the end of 1959. The net sales price of the oil was in excess of two million dollars. Cost of the fracturing treatments amounted to 3 cents per barrel of oil produced or less than two per cent of the total cost of producing the oil.

For this two per cent, the operator changed a flood that was headed for economic failure into an excellent financial success.

These field studies are just two more examples of how Dowell services can help operators improve production, keep down costs, improve profits and speed payout on investment.

You may run into a wide variety of problems in addition to oil production when you operate water disposal, gas injection or waterflood facilities. Your Dowell representative has a wide variety of services and products—both new and old—to help you solve your problems. A few examples are noted in the box below.

In addition to those services mentioned here, Dowell offers the Frac Guide*, the Acid Guide*, Cealment*, Corban* and Freflo* to help solve problems of secondary recovery. For more information on how Dowell can help you increase profits from your secondary recovery, pressure maintenance, water disposal or gas injection projects, **dial Dowell.** Dowell services and products are available from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina and Germany. Dowell, Tulsa 1, Oklahoma. *Dowell Trademark

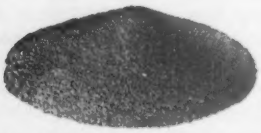
Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

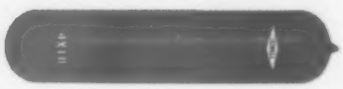
MORE IDEAS FROM DOWELL

TO HELP INCREASE PROFITS FROM SECONDARY RECOVERY



MAGNESIUM PELLETS

are often pumped into the formation before acidizing to heat the acid and melt away heavy hydrocarbons that might be blocking either injection or production. These treatments have proved remarkably successful.



ROCKSHOCK*

(Implosive formation treating service) is proving valuable both for formation cleaning and fracture initiation. It often makes possible the fracturing of formations that could not otherwise be fractured.

EZEFLO*

is a new Dowell surfactant. Available in bulk, it is especially useful for lowering water injection pressure. It is suitable for any use where an efficient, concentrated nonionic surfactant is indicated.

A TALE OF TWO FLOODS

HOW TWO WATERFLOOD OPERATORS INCREASED

CASE NUMBER ONE

This major oil company, operating a shallow waterflood unit, was experiencing severe declines in some producing wells.

In 1956, five wells were fractured. Production increases were so encouraging that the fracturing program was continued. Results have been analyzed only through 1958, but recent experiences have been at least as good or better than earlier results.

During the three years under study, 52 producing wells were fractured by Dowell and 6-month tests were obtained.

Production before fracturing averaged 2.1 bopd for all 52 wells. Six months after fracturing, production averaged 19.5 bopd—an average increase of 17.4 bopd or a percentage increase of about 930 per cent.

In addition to the producing wells, many injection wells were also fractured so that increasing volumes of water could be handled with a minimum addition of wells and pumping equipment.

Three-month reports are available on 20 such injection wells. Before fracturing, the wells would take an average of 44 bwpd at line pressure. Three months after fracturing, they would take an average of 202 bwpd—a 4.6-fold increase.

No exact monetary value can be placed on this increase, but it is obvious that the system could handle more water without increases in equipment and power requirements.

CASE NUMBER TWO

This independent operator started flooding a Bartlesville sand pool that had been abandoned. The field was originally opened up in 1917 and had been depleted by primary methods.

Early in the flood, the operator found that conventional five-spot flooding of the central part of the pool did not yield economical production. A general policy was developed to inject water in the central part and drill producing wells around the periphery.

Apparently there was still considerable oil in place along the edges, but the relatively tight formation prevented profitable producing rates without fracturing.

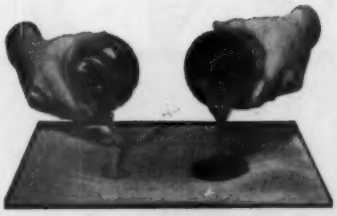
In 1952, the first two fracturing treatments were performed. Results were so encouraging that a systematic program of drilling and fracturing was started. By

THE STORY AT A GLANCE

- Location — **Eastern Kansas**
- Operated by — **a major oil company**
- Number of fracture treatments — **52**
- Average production per well before fracturing — **2.1 bopd**
- Average production per well **six months** after fracturing — **19.5 bopd**
- Average per cent increase in production — **930 per cent**
- Approximate cost of all treatments — **$27,000**

ABRASIJET*

(Dowell-developed abrasive jetting service) can be used to initiate fractures, perforate or clean the formation face. On injection or disposal wells the result is often a good increase in receptibility and/or a lower injection pressure. On producing wells, the results have been higher production, better gas/oil or oil/water ratios or improved results from fracturing or acidizing.



STABILIZED ACID

is regular acid with a special addition agent to prevent the deposition of gummy iron or aluminum hydroxides which might otherwise plug formation pores.

GYPBAN*

is a Dowell agent that is used to prevent formation plugging by water-formed gyp deposits. It is oil-insoluble and dissolves only gradually in water, thus providing months-long protection.

VOTE FOR

the Winning Ticket!

Warren QUALITY ★

Warren QUANTITY ★

Warren SERVICE ★

FOR

DEPENDABLE

DELIVERIES OF

Natural Gasoline

WHATEVER THE GRADE, WHATEVER THE VOLUME

WHEN, WHERE and the WAY You want it!

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS, SAN PEDRO, CALIF.

Cost cutting is taking on a brighter aspect

THE MOOD of the oil industry this fall has been described by one observer as "pessimistically optimistic." That seemingly contradictory phrase explains a number of things that are happening.

A few months ago the general feeling was that things would get worse before they got better.

Today most people in the oil business feel that things probably won't get worse, but neither will they get much better for a long time. So they are preparing to live with current conditions perhaps indefinitely.

THIS NEW ATTITUDE is significant. It is a marked change from the reaction when the industry first realized that its growth rate had slowed abruptly.

Then the industry had to put the brakes on its momentum. It had to correct—in fact, overcorrect—its excesses and its expansionist psychology. There was a wave of painful retrenchment and drastic curtailment in operations, personnel, and programs.

This negative, but necessary, phase is now about over. The industry has got rid of most of its fat and flabbiness and is beginning to build muscle and sinew.

Now comes the positive phase of the readjustment, the digging in for a long, hard pull. The prevailing thought is that things are going to be tough but we can make out if we plan carefully and work efficiently.

In this light, the search for ways to cut costs takes a new direction. Instead of emergency nonspending, the emphasis is being put on finding techniques that will produce long-range economies and adapt the industry to a sustained period of moderate growth and severe pressure on prices.

This is evident in every division of the oil business. In exploration, for instance, there is more restraint in lease bidding, more selectivity in holding undeveloped acreage, more efficiency in gathering scouting, logging, and subsurface information.

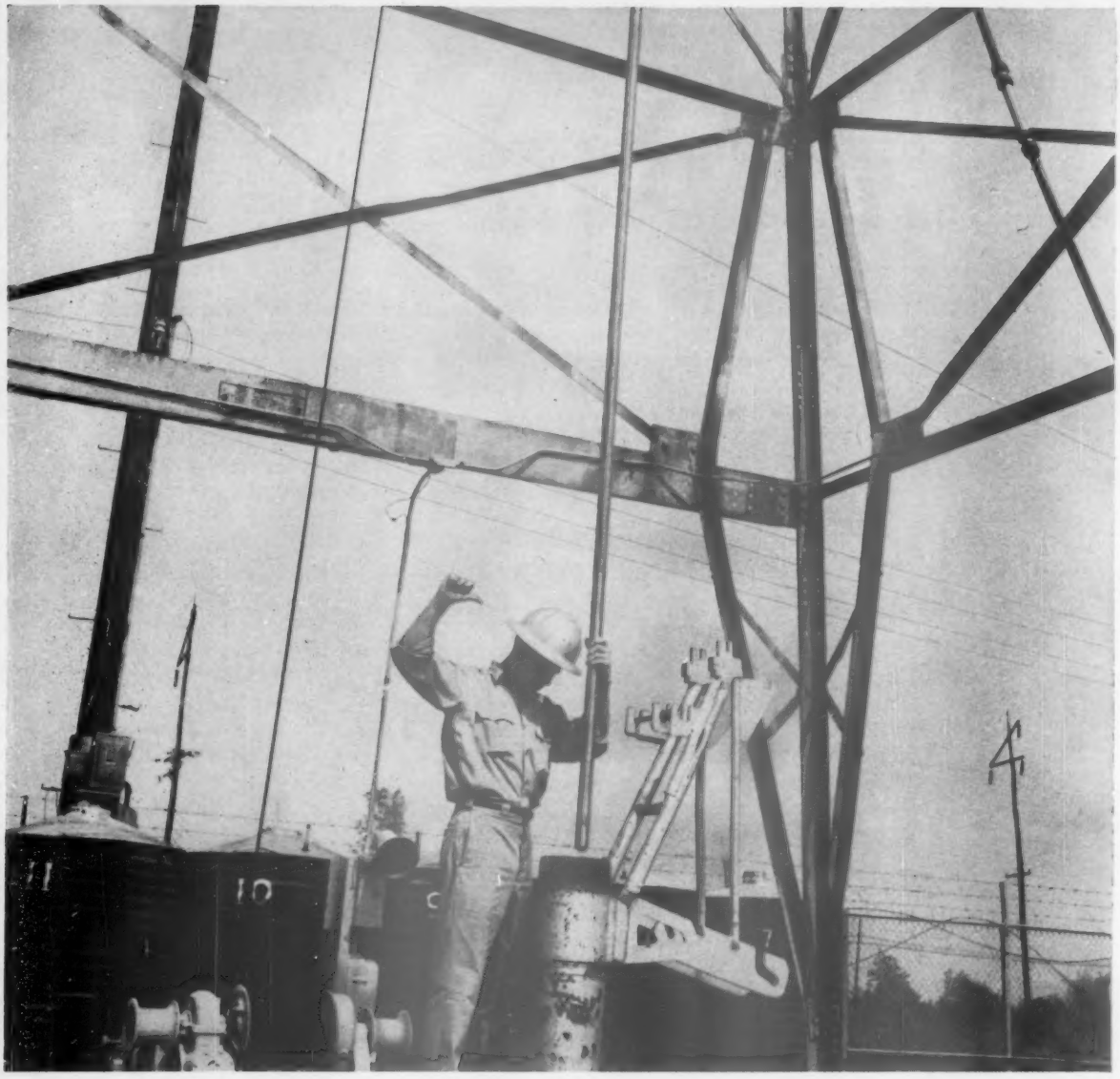
In drilling there is redoubled research into new ways of making hole. In production there is a definite trend toward getting more oil per well through wider spacing, unitization, and greater (even though slower) ultimate recovery from the reservoir.

In marketing there is a searching reexamination of practices with a view to shifting the goal from gallonage to profits.

THIS KIND OF COST CUTTING is the constructive fruit of the industry's current pessimistic optimism.

We need more of it. We haven't yet shaken free of all the sloppy habits and wasteful practices of the old lush, rush days.

But the growing determination to adapt to what may be a permanently different environment for oil promises to build a sounder and stronger industry in all its branches.



How "K" Monel helps to probe secrets of inner space . . . with radiation

One of the most important developments in determining sub-surface formation characteristics is simultaneous radioactivity logging. It gives an accurate picture of structure and porosity at various depths.

Vital space savings were realized when the logging tool manufacturer—Welex, Inc., Houston—specified a casing of "K" Monel* age-hardenable nickel-copper alloy. The tool is packed like a sausage with instrumentation. "K" Monel alloy is heat treatable to a minimum tensile strength of 140,000 psi and a minimum hardness of 265 Brinell. This alloy makes a casing that's lean but sturdy, and hard enough to resist scoring and wear in narrow, abrasive spaces.

Non-magnetic. Resists corrosion, radiation, fatigue. "K" Monel alloy has remarkably low permeability: less than 1.01 at room temperature. It remains non-magnetic down to —150°F. It offers outstanding resistance to chloride ion stress-corrosion cracking, and to general attack or pitting by hydrochloric acid, carbonates and hydrogen sulfide. It provides needed resistance to repeated shocks and stresses.

To put these advantages to work, specify "K" Monel alloy for *your* equipment. It's freely available, easily and economically fabricated. For detailed data on "K" Monel alloy, and for help in solving problems in materials selection, write to us at:

*Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia

"K" MONEL®

Report from Beirut:

Arabs Want World-Wide Stability

• Spokesmen for producing countries leave no doubt they are unhappy about the weak crude-price structure and oversupply problem. They see international prorationing as the answer, but companies aren't buying this approach.

Paul Swain
International Editor

IF THERE is a central theme at the Second Arab Oil Congress, it is certainly the professed desire of the Arabs to divide up the the oil market between themselves and Venezuela and bring about price stability by some form of international proration.

With more than 600 delegates here from all over the world, it is almost a misnomer to call this an Arab congress, but for the most part the non-Arabs are only interested observers.

It is an Arab show, but the Arabs are far outnumbered by sizable groups from the American and British oil companies who produce the Arab oil and from a dozen delegations from other interested countries including the Russians, Czechs, Romanians, and Yugoslavians.

The program itself clearly reflects what a massive chess game has developed between the producing countries and the western oil companies. The Arab speakers and those who represent the Arab producing countries are all calling for changes in pricing practices, changes in concession terms, and, most of all, a change in the present system of things to give Arabs more voice in the oil industry.

Spokesmen for the Western companies without exception are very politely and very gently engaged in attempts to spell out the industrial facts of oil industry life from the podium. Their story to the obviously discontented Arabs is that things are good now and will get better. Any change would only upset an oil applecart that will be running smoothly again just as soon as oil consumption catches up with present productive capacity.

There is almost no effort to challenge controversial Arab viewpoints from the floor, just as at Cairo at the first congress 18 months ago. The British are more vocal in this respect than the Americans.

The American company position was pretty well set the second day of the congress by W. D. (Woodie) Butte of Jersey Standard's London office who took the floor to reply to the opening remarks of Mohamad Salman, secretary general of the congress.

Salman had repeated the resolutions passed by the first congress, all of which the Arabs feel have been ignored by the oil companies. Salman also lashed out at the recent price reductions in Middle East oil. He commented that the reductions have cost the companies a great deal in good will among the Arab people.

"I simply did not want to let this opportunity pass by without making a point of the extent of bitterness felt by Arab public opinion towards the companies' position which has borne until now the mark of obscurity as well as that of challenge," Salman said.

In an almost classically diplomatic reply, Butte pointed out that the companies are aware of their responsibilities to the Arab world.

"We in the oil companies are very conscious of the fact that, in employing us to find, produce, and sell your oil, you have entrusted us with responsibilities which are of vital importance to the welfare of your countries and peoples. They call for us to exercise our judgment in matters that are important both to you and to us.

"We do try hard to perform all these tasks in a manner that will continue to justify your confidence. Whenever in any matter, large or small, you disagree with something we have done, we are sorry that this is so.

"Whether what we have done is in fact right or wrong, the fact that you feel it is wrong or that you do not understand why we have done it is a failure on our part."

Then Butte delivered his clincher:

"There are many things that can be discussed in large meetings such as this. There are other things that can best be discussed when we sit down with representatives of the Government with which we work, in small groups of experts around a table, with maps and books and records and the informality of personal contacts that only such a group can give.

"You and we are working together. We must never be on opposite sides of the table . . . Only thus can we realize the great future oil developments hold out to the people of the Arab world."

Proration . . . The only address that sparked any discussion from the floor early in the congress was one outlining a possible formula for proration of production on an international level.

It is the particular scheme of Shaikh Abdullah Tariki of Saudi Arabia and was delivered by M. J. Sladic, an American engineer who until recently was employed by Tariki's Directorate General of Petroleum and Mineral Affairs in Saudi Arabia.

Sladic himself voiced the opinion that regulation that would necessarily come with the proration scheme was something that he personally disliked, but said it would be necessary to solve the problem of surplus productive capacity and stabilize conditions in the industry. His involved formula would allocate production based on a combination of the average of 3 past years of production plus a factor based on reserves and another on demand.

The Sladic paper prompted some very gentle reminders from British representatives that proration might appear attractive now, but it contains many ills which the Arabs might not want to live with later.

It also drew an impassioned speech from the floor from Emil Bustani, Lebanese politician and big Middle East contractor. Bustani, arch foe of

Tariki, delivered a blistering denunciation of the Russians for what he called "political dumping" of oil in today's market. He pointed to Italy as an example of a country which is increasing its purchases of Russian oil at the expense of Arab producers.

"We must get together with Italy and remind them that they are now operating in the Middle East and looking for oil here," he said. "It would behoove them to consider the damage they do when they buy large amounts of Russian oil as they are now doing."

The most pointed Western reaction to the proration scheme came from M. E. Hubbard, British Petroleum Co. economist who reminded the Arabs that "consumers will call today's proposal a producers cartel and as you know that is a dirty word in the West."

Politics . . . If there is to be any real fire from the congress, it is not apparent at this mid-point.

The recent formation of the Organization of Petroleum Exporting Countries in Baghdad has taken all the political steam out of the Beirut meeting and has definitely confined the Arab League-sponsored congress to a back seat in Middle East oil affairs.

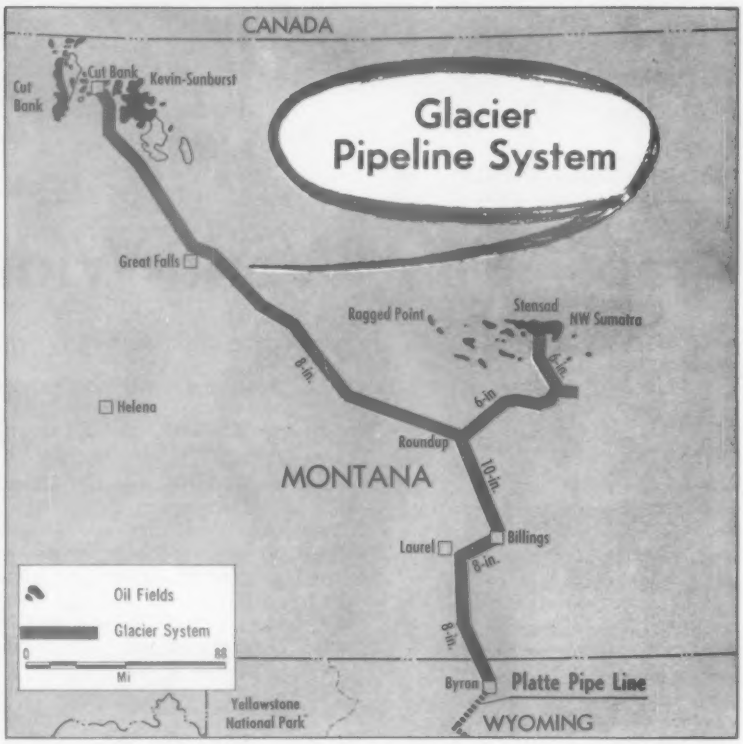
The organizers of OPEC, which excludes the politically potent United Arab Republic and the other nonproducing Arab countries, are only going through the motions at Beirut. They literally exude confidence that their producers' group will be able to act in concert and will accomplish the aims that this congress has so far failed to achieve.

Shaikh Tariki is presiding at the "Petroleum Economics General and Miscellaneous" sessions and has reserved his broadside on pricing for the final day.

The Iranians, who took part in the formation of OPEC in spite of their political disrepute among the Arabs for the facto recognition of Israel, are not here. The Iraqis, who did not attend the Cairo congress because of political differences with Egypt's president, Gamel Abdul Nasser, have not appeared in Beirut.

Venezuela's Minister of Mines and Hydrocarbons, Dr. Juan Pablo Perez Alfonzo, has emerged as the strong man of OPEC and now overshadows Shaikh Tariki as the leading architect of Arab-Venezuelan cooperation. He is taking such a casual approach to the Beirut congress that after the formal opening he went off to Damascus on a sightseeing trip.

For additional coverage of the Second Arab Oil Congress, turn to page 80.



Montana Crude Line Planned

. . . to provide midwest outlet. The project marks the first pipeline service between Great Falls, Billings.

BOTTLED-UP CRUDE in Montana will have a pipeline outlet to the Middle West by mid-summer of 1961.

Continental Pipe Line Co., a Continental Oil Co. subsidiary, is building a 433-mile crude line from Cut Bank, Mont., to Byron, Wyo.

The line will generally parallel other crude lines on the northwest and southern sections, but it will be blazing a new trail between Great Falls and Billings in Central Montana.

Also the new line will have a 55-mile spur extending northeast from Roundup to a number of Central Montana fields.

At the southern end, the line will connect with other lines to move the crude into St. Louis, Chicago, and other midwestern centers.

Continental will call its new line the Glacier Pipe Line System. It will cost $13.5 million to build and will have diameters of 10, 8, and 6 inches.

The longest section, from Cut Bank to Roundup, will be 8-in. The spur extending out from Roundup will be 6-in.

Between Roundup and Billings the line will be 10-in. and beyond that (west to Laurel and south to Byron) 8-in. again.

R. H. Fulton & Co., Lubbock, Tex., has the initial contract to start work on the 10-inch section moving northwest from Billings. The contractor says he is making plans to complete as much mileage as possible before weather gets too severe. Work will resume in the spring.

Initial capacity of the line will be 50,000 bbl. of crude daily. Continental expects to move 200 million barrels of Central and western Montana crude through the line over the next 25 years.

President W. L. Kygar of the company said last week that production in the two areas has been hampered because of limited markets and the high cost of truck and rail transportation.

Current daily production from the two areas is about 25,775 bbl.

Kygar said exploration and development have been stifled for years, and a number of water-flood projects have remained on the drawing boards "because the companies didn't want to give the crude away."

Imperial Attacks Proposed Line to Montreal

• Fencing off Montreal market for western Canadian crude is not the solution to producers' problems, Imperial says. The best bet: Move more crude to the Ontario and Puget Sound areas.

WESTERN Canadian oil producers could use additional market outlets but the situation doesn't justify government intervention and possibly government subsidy.

This is the gist of a major statement released by Imperial Oil Ltd. in Ottawa last week, commenting on the proposal to reserve the Montreal market for western Canada crude.

At an Ottawa press conference, J. A. Cogan and T. W. Moore, Imperial vice presidents, declared that western Canada crude simply can't be piped to Montreal at prices competitive with Venezuelan and other foreign crudes. Moving the crude to Montreal by pipeline would place a burden in the order of $50,000,000 annually on domestic and industrial consumers in Quebec.

The situation . . . Canadian oil operations this year will have an estimated net deficit of $415,000,000. The country will import $540,000,000 worth of Venezuelan and Middle East crudes and sell $125,000,000 worth of crude to the U. S.

Western Canada producers want to correct this situation by fencing off the 250,000-bbl. Montreal market for Canadian crude. This would involve laying of a $350-million line from Alberta oil fields.

The Canadian Government, caught in the cross-fire, currently is studying data compiled by the National Energy Board. It is expected to make a decision later this year (OGJ, Sept. 12, p. 78; Sept. 19, p. 59).

Imperial's stand . . . In attacking the proposed pipeline, Imperial says it is not sound. To build it would require government intervention along one or more of the following lines:

. . . A system of protective tariffs which would raise the cost of energy in all Canada.

. . . Transportation subsidies which would be difficult to determine and administer under constantly changing market conditions.

. . . A complex quota system involving control of imports of crude oil and essential products; control of movements of crude oil and products between provinces; and ultimately leading to the regulation of energy prices.

"This would appear to set a dangerous precedent in the direction of a high-cost economy," Imperial says.

At present wellhead prices, western crude oils have a price disadvantage of 30 to 60 cents per barrel when laid down in Montreal by pipeline. If refiners there are forced to use Canadian crude, the $25 million to $50 million higher cost will be either passed on to the consumer or will be borne by Canadian taxpayers.

Role of natural gas . . . In setting a target of a 700,000 bbl. daily crude production in Canada by the end of 1960, the Borden Commission failed to consider the role of natural gas, Imperial points out.

Because oil and gas are produced jointly by the same companies and compete in the same markets, Imperial says the fuels must be considered together. When considered from this viewpoint, Canada's equivalent crude output this year will be 745,000 bbl. daily. This is about an 11% gain over 1959 and some 30% over 1957. Additional gas exports to start in 1962 will be equivalent to 150,000 bbl. of crude daily.

Higher producing rates for western Canada fields will not materially benefit most Alberta producers, the Imperial statement also points out. Most producers are already operating at, or near, capacity. Only a few companies—less than 30—would share almost all of the market gained by a Montreal pipeline. And most of these companies don't favor the project because it would be uneconomic.

The solution . . . As Imperial sees it, the thing for Canadian oil producers to do is seek further growth in the domestic and export markets served by existing pipelines. Two possibilities cited are:

. . . Increasing the Ontario market by some 50,000 bbl. daily through an orderly reduction in the remaining volumes of crude and products which are coming into the southern part of the province.

. . . Expanding the export market through exchange agreements which will result in more Alberta crude moving into the Puget Sound region. Also, it was pointed out, northern states from the Pacific to the Great Lakes are looking more and more at Canadian crudes as a significant supply source.

Texas Holds to 8-Day Allowable

TEXAS held stubbornly to an 8-day producing pattern for the seventh consecutive month at the state-wide allowable hearing in Austin last week in an effort to drive down excess products stocks.

The initial allowable for November will be 2,667,508 bbl. daily. This is an increase of 56,111 bbl. daily from the allowable in effect October 8 and is up 36,932 bbl. daily over the initial allowable for October. The increase comes from the 8 producing days being spread over only 30 calendar days in November as compared to October's 31.

Major purchasers overwhelmingly supported the 8-day schedule. Eight of them nominated for 8 days with two favoring 9 and two favoring 10-day pattern. Humble Oil & Refining Co., as it has for the past several months, testified it stood to lose markets for Texas crude on any pattern below 10 days. The company said it had been able to buy on the spot market only 7,300 bbl. daily in October of a desired 70,000 bbl. daily.

Charles Shaver, representing Humble, said Humble would need to buy 90,000 bbl. daily in November on 8-day or 60,000 bbl. daily if 9 days were adopted.

Commissioner Olin Culberson questioned the wisdom of further Texas attempts to cut products surpluses by holding down crude allowables. Despite intensive efforts by the commission, he said, refiners have continued to charge crude to stills at high rates. He said it appeared Texas is merely shoving some of its crude market over to importers and to other states.

IPAA Meeting Tackles Crucial Issues

• A Journal survey among chairmen of key IPAA committees gives an indication of policies the association may adopt on major issues affecting domestic producers. Decisions at this time will be vital.

Clyde La Motte
Washington Editor

THE Independent Petroleum Association of America is meeting in Dallas this week in an atmosphere crackling with current problems.

IPAA leaders consider this one of their most important meetings in years, perhaps the most important since World War II.

This stems from the fact that the domestic industry now finds itself on an economic plateau, with more reason to fear a decline than to anticipate a major upswing unless corrective steps are taken soon.

It stems, too, from this situation: A number of key issues affecting IPAA members are at a crossroad, so that decisions made now are of extreme importance.

One of these concerns the recent policy announcement by the Federal Power Commission on gas-producer regulation.

Another is the oil import control program, with the Interior Department in particular and the Administration in general taking a second look to determine what, if any, changes should be made.

These, and others, are vital "pocketbook" problems for producers. They will be the center of attention in formal meetings and in corridor discussions in Dallas.

The big question, naturally, is whether the IPAA can come up with the answers.

There are indications that the organization is making some headway.

What the association will decide at Dallas remains to be seen, of course, but a pretty good idea can be gained by taking a look at the direction in which IPAA committees are headed.

Like many organizations, much of the basic work done by the IPAA is shaped up by its committees. IPAA has 18 of these committees covering a wide range of industry activities.

Among the more important of the committees in view of current problems are the natural-gas committee, import-policy committee, supply-demand committee, special-depletion committee, and the cost-study committee.

The Journal last week asked the chairmen of these five committees for a progress report on what their committees are doing.

Their replies, although naturally not committing the IPAA to any course of action, do indicate some of the principal developments to expect in this week's membership meeting in Dallas.

1. Natural gas

Do not be surprised if the IPAA modifies the flat opposition it voiced to the area-pricing approach when that plan was first announced by the FPC.

It will continue to insist that legislation is still needed, preferably clear-cut decontrol, but it will concede that area-pricing offers possibilities. In the end, therefore, IPAA may accept the area-pricing approach if it is backed by congressional action to assure permanency and to avoid a long test period that would hamper the industry.

This is how Richard T. Lyons, chairman of the IPAA gas committee, sizes up the situation:

"There is ground for hope that the area-pricing approach will provide relief from some of the administrative burdens now facing the industry and the commission.

"In addition, it no doubt will be helpful for the immediate future to some producers by clarifying their price position.

"However, any administrative system is subject to change and uncertainty. Such a basic and important issue should be resolved on a firm and definite basis that only legislation can provide."

Lyons pointed out that as long as the area-pricing policy is only an administrative action, producers will still face a period of uncertainty. And he noted that a future commission might discard area pricing in favor of some other policy.

"These are some of the considerations that demonstrate that congressional action is more imperative than ever before," he said.

Lyons said further that he was sure the association would try to assist producers in efforts to seek higher area-price ceilings where producers feel higher prices are justified and essential.

It is entirely possible that the IPAA may shape up a special task force to perform this function, in view of the FPC's invitation for a group approach —rather than an individual producer approach—to providing area data that affects prices.

IPAA will also continue to work with an intra-industry group in the hope of adopting acceptable regulatory legislation proposals for consideration by Congress.

Lyons thinks the outlook for passage of legislation may have been improved by recent developments, including the FPC policy action and the growing evidence that the future supply of gas is being endangered.

2. Oil imports

The IPAA will step up its efforts to get a further reduction in crude-oil import levels.

Its basic thesis is that the domestic producing industry obviously is suffering. And while it does not contend that imports are solely to blame, it does insist that it is an important factor to be considered.

IPAA already has asked the President and the Secretary of Interior to study the situation, and these efforts will no doubt be intensified if upcoming changes in import regulations are not satisfactory to IPAA.

The association feels that the present program has now been in effect long enough to provide a basis for evaluating its results.

As IPAA evaluates the results to date, import levels established in the program were too high to accomplish the program's goal of preserving a vigorous, healthy U. S. petroleum industry.

F. Allen Calvert, chairman of the IPAA import-policy committee, said this can be shown by a look at the unhealthy conditions in the domestic producing industry, including the levels of exploration, number of wells being drilled, domestic production levels, and employment.

As a result, Calvert said, IPAA "will continue to press with all concerned for import levels that will not hinder

Schultz Calvert Dumbros Lyons Hodges

Key IPAA Chairmen: Heads of five committees that handle some of the basic work performed by IPAA are Paul R. Schultz, president of Blackwell Oil & Gas Co., chairman, special-depletion committee; F. Allen Calvert, president of Calvert Petroleum Co., import-policy committee; N. G. Dumbros of Ohio Oil Co., supply-demand committee; Richard T. Lyons, president of Union Texas Natural Gas Corp., natural-gas committee; and John E. Hodges of Hughes Tool Co., cost-study committee.

the development of a vigorous, healthy oil industry in the United States."

3. Supply and demand

The supply-demand picture to be presented to the association members will not be a cheerful one for producers.

Listen to N. G. Dumbros, chairman of the supply-demand committee:

"Looking ahead at next year, or the next 5 years, it is my feeling that the rate of increase in domestic oil consumption will more or less parallel the last 5 years—that is, increase at an average rate of 2% to 3%."

However, Dumbros points out, demand for crude—both domestic and imports—has remained static since 1956, and thus crude production in the U. S. has not shared the 2% or 3% rate of growth.

Principal reasons for this, he said, are: Increase in natural-gas liquids production, improved refinery technology which allows production of more light products from the same quantity of crude, inventory adjustments, and the increased imports of refined products other than residual fuel oil.

Dumbros said also that he feels that increased usage of natural gas has affected oil demand substantially.

4. Trend of costs

IPAA, seriously concerned with rising costs, will continue to speed up efforts to provide the industry with accurate, current cost data.

John E. Hodges, chairman of the IPAA cost-study committee, said emphasis is being given to speed and accuracy in the joint association cost survey now being made. This is a project by the API, IPAA, and the Mid-Continent Oil and Gas Association.

Hodges said the current survey to get information on expenditures for drilling and equipping wells in the U. S., together with data on expenditures for exploration, development, and production, should prove more satisfactory.

He pointed out that the survey is now confined to 1959, and thus should be completed faster than surveys covering longer periods.

Also, the current survey is using a simplified questionnaire form.

"Follow-up procedures are being used to increase the number of replies, and this should help immeasurably," he said.

"Also, the committee plans to continue and, we hope, improve its own index of drilling and completion costs."

The committee chairman classified the trend to higher costs during the past 10 years as a major problem for the domestic producer.

Hodges said that although most items covered in the committee's cost index have been stable thus far in 1960, there has been an apparent increase of 130 feet in the average depth of new wells.

5. Fate of depletion

IPAA will intensify its program of telling the story of percentage depletion in the months ahead.

One obvious reason is that the change in administration and the new faces in Congress following an election year make an education program necessary.

Paul R. Schultz, chairman of the IPAA's special-depletion committee, points out that this program is a continuing one.

This is how IPAA goes about it:

...**Facts** on depletion are provided periodically to every member of Congress.

...**Material** on percentage depletion and other mineral-tax policies are supplied to any new members of the executive department concerned with mineral-tax policies.

...**Other** information, including IPAA's statistical publication, "The Oil Producing Industry in Your State," is provided to all members of Congress.

Keenly aware that there will likely be fresh attacks on percentage depletion during the next session of Congress, IPAA plans to put more than an ordinary effort behind its educational drive.

Lease Terms Cut

. . . to spur wildcats on West Texas school land.

THE TEXAS School Land Board has whacked its minimum lease terms for West Texas lands in a move to stimulate wildcatting on state school acreage.

The board said it hoped to aid a hard-pressed industry and at the same time to benefit the state's public schools. Cut in lease requirements was confined to lands which the board might offer to the west of the Pecos River.

The board plans a sealed-bid lease auction, which will include lands in that area, for December 6.

Future minimum bonus for west-of-the-Pecos acreage will be $5 an acre, while the delay rental on such leases will be $1 an acre. Oil companies previously had to pay minimum bonuses of $15 and delay rentals of $3 an acre.

The board said its new reduced terms will not apply to any tract within ½ mile of production.

Unleased land administered by the board in the Trans-Pecos area reportedly totals more than 600,000 acres.

Computers Give Atlantic's Field Men

• Setting up a data-processing center to handle information once compiled in the field has enabled Atlantic to give field men extra time to do better or more jobs—and to arm these men with more accurate information.

Robert J. Enright
District Editor, Dallas

HOW CAN a large oil company make significant gains in cutting costs and hiking efficiency in producing operations?

Try giving your industrial engineers a crack at it. Methods and systems of doing things become obsolete quickly and unobtrusively. And somewhere in your operational setup, you may have a bow and arrow instead of a missile.

Atlantic Refining Co., for one, has found that standing back and taking a fresh look at its whole producing routine can pay dividends.

Producing and engineering operations in the company's Gulf Coast region, a guinea-pig area, have taken on new zip and precision due to wholesale revamping of the division's production "paperwork" system.

The old system of keeping and reporting production data—a method used for years by the industry generally—has been thoroughly streamlined. Some data and reports have been eliminated, others simplified or consolidated.

Electronic data-processing equipment has been installed in the Dallas headquarters to digest and record the new-look production data. And new teletype units speed it, together with computations made from it, between Dallas and the Gulf Coast region's two district offices at Houston and Corpus Christi.

The new system has boosted efficiency all the way from the pumper through the reservoir engineer to management. It costs no more than the old way. And the extra benefits, though hard to measure in dollars and cents, are impressive.

Along with its faster handling of data, the new system relieves the pumper and district office of much burdensome reporting, calculating, and record-keeping. The pumper is kept closely informed on how production from his leases is running as compared to the allowables for those leases.

Perhaps the biggest bonus of all, however, is that complete basic well data is collected and stored in compact form for quick use in engineering and management studies.

Atlantic engineers now have available at their fingertips reservoir data which previously would have taken days or weeks to gather and compile.

The new data system has been in operation in the Gulf Coast region since the first of the year. It has proved so successful that the company will expand it before the end of the year to take in the entire West Texas-New Mexico region. And Atlantic hopes, by late 1961, to extend it throughout its entire area of domestic producing operations.

1. Here's how it works

The new production-data system required little in the way of new equipment.

The key instrument in the program, an IBM 650 electronic-data processor, was already in operation on accounting, payroll, and other chores in the Dallas headquarters.

To actuate its program, Atlantic had only to lease the teletype equipment—three Model 28 units—plus the tape-to-card and card-to-tape converters. One teletype is installed in the Dallas offfice, the other two in the Gulf Coast district offices at Houston and Corpus.

Atlantic industrial engineers marked out three areas of production-data reporting and revamped each separately. The three are: Production status reports (allowables vs. production); production history reports; and well-testing reports.

Production status reporting . . . At-

The Electronic Touch Gives Operations Zip

ELECTRONIC data-processing equipment in Atlantic Refining Co.'s Dallas office is paying dividends through cost-cutting and increased reporting efficiency.

Computations made from production data are flashed between the Dallas headquarters and the company's district offices in Houston and Corpus Christi.

In addition to the computer and teletype equipment shown in photos at right, an IBM 407 accounting machine is used in the data center. This machine prints the monthly well report, production ledgers, and periodic well-test reports along with accounting reports.

1. Incoming teletype data is card-punched at data center.

More Time to Work

lantic formerly used the conventional "control" reports—the "Gage and Production Report" and the "Over and Short" report as a check on production vs. allowables.

The lease pumper used the gage and production form to report on each tank battery each week and at the end of the month. On it, he posted his daily gages, daily stock on hand, calculated pipeline runs, calculated production, over or short barrels, and well-status data.

The district office prepared the over and short reports once a month, usually following receipt of the second week's gage and production report. This report notified the pumper of corrections of gage readings from tank tables, supplied corrections of run-ticket calculations to estimated or actual net barrels, and gave him a run-down of his status as to productions vs. allowable.

From a control standpoint, this procedure gave the pumper only one verification of his calculations through the first part of each month. The time and expense that would have been required to recheck the calculations and issue added reports was prohibitive.

Under the new system, the pumper gets a machine-preprinted gage report prepared by the Dallas data-processing unit.

He no longer must post identification data, daily and weekly over and short calculations, and run-ticket data (except for the date and ticket number). He now posts only the gages, well-status dope, weekly allowable for the battery, and run-ticket dates and numbers. Also, as in the past, he must report any acquiring or disposing of oil other than run tickets which affect allowables. But these are infrequent.

The district office makes a quick count of run tickets and checks to make sure the gage reports are properly completed. Then it punches an off-line paper tape and relays the data to Dallas via teletype.

Use of the tape permits the district to prepare the data for transmission at a convenient time and send it later on—perhaps after voice use of the circuit ends or after working hours.

In Dallas, the computer quickly corrects gross run tickets to net barrels, calculates production, and determines over or short balances. The figures are converted mechanically to tape form and fired back to the district office.

Elapsed time at the district from receipt of data from the pumper to arrival of finished calculations from Dallas is about 24 hours.

The pumper closes out his report each Monday at 7 a.m. and at the end of each month. And he receives his weekly and monthly production status reports 72 hours later.

Dallas data-processing prepares separate reports for co-owners at the end of the month. And it passes on a copy of the end-of-the-month report to the oil-accounting unit for the state production report.

Advantages of this system are:

1. Pumper gets pre-identified form, records much less data, and makes far fewer computations. Thus he can pump more wells or do a better job of pumping the same number.

2. District accounting is relieved of data consolidations, computations, and checking. The upshot is that fewer clerks are needed.

3. Compact printed form is substituted for former bulky, manually prepared records on a lease and assignment basis.

4. Figures on status and production are more accurate and timely and much more easily audited.

5. Weekly check gives all operating levels a firm feel of allowable status of well, lease, field, district or region at any given time during the month.

Production history reporting . . . The "Monthly Well Report" is prepared by the lease pumper by the well for each battery and each formation.

Formerly he had to report: Status of the well; data on the allowable; production statistics and volumes for oil, gas and water; a production test which was considered "representative" of the way the well produced during the month; total pipeline runs for each battery; over and short information for each battery; any use of chemicals or inhibitors; anything unusual or important in the operation of the well or battery during the month.

He had to calculate: Average per-well oil output on the days the wells produced; production per calendar day, oil and gas; gas-oil ratio, etc. The district office usually completed its portion of the report (computations and consolidations) in the latter part of the month following production after gas volumes had been determined and entered on lease gas reports.

Now the pumper gets a new report

2. Computer makes necessary calculations.

3. Taped data is printed on production-status form.

Engineers Keep Scissors Busy on Red Tape

MUCH OF the credit for the streamlined new look in Atlantic's production department goes to the company's methods and standards department—more specifically the Southwest division of that department.

Rex Struble heads the division, made up of nine industrial engineers. Main job of the division is keeping a constant eye on how Atlantic does things—and, where needed, making changes that improve the company's competitive position and productivity.

The basic objective is to find better ways of using men, material, and equipment to either cut costs or increase productivity at no increase in cost.

The division works mainly with projects in two areas—field operations and company paper work and procedures. Its work in these two general areas breaks down further into three major types: Data processing, performance standards, and management of costs.

Rex Struble

Industrial engineering isn't new, Struble points out.

"The industry became aware of the need to increase productivity while holding the line on costs during the 1930's. But only in the past few years has it appeared to be coming into its own in the oil industry—especially in the exploration and production field."

Struble thinks it is destined to become more and more important—particularly in the area of office and administrative procedure.

This, he says, "is an area often neglected. Business as a whole must watch its administrative areas closely in the future. If overhead paper work continues to grow in volume and complexity as it has in the past 15 years, these costs could prove the last straw for many firms."

Atlantic's industrial engineers have concentrated heavily of late on the overhaul of production department paper work and procedures.

"Our ultimate goal is to assist in bringing all parts of the whole to the same level of efficiency.

blank—pre-identified mechanically by off-line teletype in the district office—with the pumper's name, field name, reservoir name, lease name, well number, and well status code preprinted.

The pumper needs only to post the allowable days and monthly barrels, the number of days produced, average hours produced per day, the water cut, and allocation of battery production to the wells. If the well's status changes, he also notes this. District accounting completes the gas volumes.

The data is teletype-taped to Dallas where it is processed through the 650 computer and merged with the card records. The computer does all necessary calculating and prints an updated report.

Together with the routine well status, allowable and production figures, the computer calculates and prints on the report cumulative production by well, lease, reservoir, field, and district.

Normally, the data for the report is due in Dallas around the twenty-fifth of the month following the month of production. And the completed report is mailed back to the districts before the end of the month.

A delaying factor is the problem posed by gas production. Where a well produces gas with either distillate or oil, a considerable wait is involved before the company finds out from the purchaser how much gas was produced and sold. This is essential before accurate gas-liquids ratios, for instance, can be calculated.

Were it not for this delay, Atlantic figures it would be able to complete the monthly production report as early as the second or third day of the month following the month of production.

There is, however, no need for haste in turning out this report. And the monthly rundown is mailed back to the districts rather than teletyped.

Now, each 6 months, the Dallas data-processing center spews out a ledger with a complete production history of each well, lease, and reservoir in Atlantic's Texas Gulf Coast region. It also produces a similar biennial report.

The ledger will simplify reservoir studies and eventually make it possible to throw away the individual well reports.

The potential of such a mechanized system—where a complete producing history of any given Atlantic reservoir is available in a few minutes with the mere punch of a button — is tremendous.

Reservoir engineers can devote near 100% of their time to engineering rather than wasting a big portion simply gathering and calculating data.

Along with this big plus, the new system again cuts substantially, for the pumper and district office personnel,

... **Preparing and logging** report data.

... **Calculating** report data. Calculations previously performed manually by the lease pumper and district office personnel are now polished off mechanically in a fraction of the time in the Dallas data-processing center.

Well-test data . . . Production-test information formerly was reported on nine different test forms, many involving only minor changes in the location of data or the addition of one or two recordable items.

Basic data was posted on the form by the lease pumper. Gas charts, if any, were attached and the reports forwarded to the district office. Here, gas volumes, G.O.R.'s, and 24-hour rates were calculated. These figures were posted on the form. A copy was returned to the field for use by the foreman. Finally, test data for each well was posted in the district office in a production test ledger.

One standard form is now in use. It includes space for chemical and in-

hibitor data formerly carried on the monthly well report.

Reporting procedure remains about the same, except that a copy of the test form as completed by the district is mailed to the Dallas data-processing center. The test data is key-punched into cards and recorded by reservoir, lease and well.

The center each month turns out and mails to the districts a well-test record report. It is completed and mailed within 10 days following the end of the month in question so that the district can use the report in allocating gas for the production data record.

Some advantages of this new way of handling well-test data are:

1. Well-test data now is available quickly and in complete form for engineering study via computer.

2. Tedious chore in districts of keeping test ledgers manually is eliminated, together with the involved addition and cross-checking.

3. Reduction in the number of test forms has done away with confusion—provides better control and accuracy.

2. Other benefits, uses

Atlantic's reservoir-engineering department has been highly aggressive in analyzing its own operations and developing more new uses for this versatile new computer - communications tool.

The company's industrial engineers paved the way for this by designing the basic system so that the reservoir-engineering department could use the data files for any desired project without red tape. "Open-house programming" is what Atlantic calls it.

Field problems solved . . . One promising and already proved application is the solving of tedious reservoir problems for the company's engineers in the field.

Engineering data is transmitted to Dallas from the districts. The computer makes the calculations and automatically prepares and returns study answers to the district.

The data derivations combined with the machine integration offer a means of preparing engineering studies in a manner and on a scale formerly prohibitive by volume and cost.

Such studies now possible economically include: Solution gas drive, productivity index, decline calculations, oil and gas material balance, equity calculations, and water-drive analysis, among others.

Atlantic intends to get maximum mileage from this application. And to make sure it does so, the company is bringing field engineers into Dallas for a couple of weeks of schooling on the new mechanized look and its possibilities and potential.

Engineers in the West Texas-New Mexico region will be ready when that region comes under the computerized production program shortly. Engineers in the company's other regions also will be brought in as the program is broadened throughout Atlantic's domestic operating area next year.

Uses expanded . . . The unique system has unused capacity. This is rapidly being filled, and will tend to make each application still more economical.

The computer recently started first runs, for instance, on a carefully planned program for mechanizing the company's tubular-goods inventory procedures. Early results suggest that here again Atlantic has found a promising means of cutting costs while at the same time hiking efficiency.

Still another program being whipped into shape for its first computer run will mechanize the company's annual reserves tabulation.

With annual and cumulative production figures already on punched cards (via the new production data report), computerizing the reserves report is a natural and relatively simple step.

Computer time for all these programs is scheduled smoothly so there is no conflict with payroll, accounting, and other regular runs. And, along with these, the 650 has been working on exploration programs. The results, the exploration department hopes, will make Atlantic's oil finding as well as its oil-producing efforts still more efficient.

Oil Firms Welcome Bigger Computers

ADOPTION of larger and faster computers by the oil industry marks the beginning of a new era of machine coordination of world-wide operations.

Big computers that formerly were restricted to defense industries and government installations are being snapped up by oil companies.

IBM's 7090, newly arrived at Socony Mobil Oil Co., Inc., headquarters in New York, replaces the erstwhile giants, the 704 and 650, which had been leased by Socony.

This is the first time an oil company has obtained a 7090. The new computer will accomplish more for Socony, at lower cost, than the former two combined.

Standard Oil Co. of California will take delivery on another 7090 in a few weeks, and half a dozen other oil companies will install 7090's soon.

This computer will be a key to electric data-processing systems that will permit closer, more economical supervision of supply, transportation, manufacturing, and distribution of petroleum.

Socony operation . . . Socony's computer center in New York will now be able to store mathematical models of the company's refineries throughout the world.

Here's how the company will put the computer to work:

. . . **Forecasting** light product sales volume.

. . . **Complete file** of alternative transportation costs.

. . . **Determining** distribution methods of light products.

. . . **Comparing** combinations of refinery models and product distributions.

. . . **Storing** crude-producing models as well as refinery models.

. . . **Engineering** process design.

The computer also will be employed in research problems in exploration, production, and manufacturing.

The 7090 is six times as fast as its big predecessor at Socony, the IBM 704, and 7½ times as fast as the 650 which also was used by the company. It is expected to handle all the work that formerly required both—and at a saving of $4,000 per month in total lease time.

Socony also expects to derive other benefits. The 7090 requires less floor space, less air conditioning, is faster and more reliable, and has greater flexibility for handling other problems during peak loads.

Problems that required 100 hours to solve on the 704, once the fastest computer leased by IBM, can be solved in 20 hours on the 7090. The new machine can perform 229,000 additions or subtractions in 1 second and its magnetic core storage can hold more than 32,000 10-digit numbers. Any of these problem or instruction numbers can be located and made ready for use in 2.18 millionths of a second.

The 7090 will be used by virtually every department in Socony's New York headquarters. Socony now has nine computers—two in New York, three in Dallas, and one each in Los Angeles, Paulsboro, N. J., Beaumont, Tex., and Caracas, Venezuela—in operation.

CONTRACTORS WILL CHECK an isolated well like this 25-year-old installation . . .

. . . inspect small-project tankage . . .

Versatile Contract Service Makes Hit

• Some finding it cheaper to let contractors handle routine operations and upkeep, whether the job involves a single well or a field. The next move may be contract-service arrangements for running full units.

A NEW type of contracting service—oil field operations—is catching on fast in the oil industry.

It began a few years ago as an occasional contract for a pumping job or well workover. But now independents and majors alike are hiring contractors to handle isolated wells or even run an entire field.

Reason for the sudden growth: Contractors are able to do the job much cheaper because of natural economies they are able to effect.

The contractors too can offer nearly any kind of field service. They can offer in a single package:

Pumping and gaging, water flood operations, treating and well servicing, maintenance of properties, shallow-well drilling or deepening, laying small pipelines, placing full insurance coverage, buying of materials and equipment, preparation of reports to regulatory agencies.

They also may offer:

Engineering assistance, recommendations for production efficiencies, or changes in operation if they feel money will be saved.

Why the growth . . . Greatest selling point for the new breed of contractors is their ability to do the work as well as a company but at less cost.

Contractors in many cases have been able to cut costs as much as 50%.

Companies have found that their own fixed costs in operating older fields are excessive. This is due in part to their long-service, higher-paid workmen, and heavy investments in field and district-office physical plants which have to be maintained in the face of declining production.

The contract operator by working for several operators in a field and because of lower overhead is able to spread these costs or even lower them.

Contractors have scored their greatest success in older fields that were limping toward abandonment and in areas with heavy concentration of activity by many operators. By ending a duplication of work, contractors are able to cut costs drastically.

An example is one field which is currently being studied by a contractor for a package proposal. The field is in its late producing stages. It is 17 miles long and has 1,800 wells making nearly 7,000 bbl. of oil daily. Seven major companies maintain field offices there. As now operated, the field is becoming marginal.

One contractor estimates he can cut operating costs 40%, which will make the field more financially attractive and will prolong its economic life. Through this approach, contractors estimate they can increase oil reserves and profits for their customers.

Other cases . . . Several operations are cited by contractors to illustrate their ability to lower costs.

Three leases with three producing wells had been operated as a joint-interest venture. Operating costs on the wells were $75 per month each, plus $35 monthly each for overhead expense. The total monthly cost was $330. One contractor took over the job for a contract fee of $120 a month.

One major company had a six-well lease in charge of a full-time pumper. His salary was $404 a month plus benefits, insurance coverage, and expenses. A contractor is doing this work for $40 per well monthly or $240. The pumper was transferred to a warehouse job.

Another contractor has completed a deal to handle 53 widely scattered wells.

Part-time pumpers, mostly land owners or farm tenants, previously were hired at wages varying from $50 to $88 monthly. Each pumper was responsible for four or five wells near his home. The leases also were supervised by two production superintendents who received about $1,000 each

. . . take care of fishing jobs . . .

. . . and replace meter-recording sheets as part of the many services they offer.

in Oil Fields

per month in salary, car expenses, insurance, and personal expenses.

The lease owners contracted to have the wells serviced for $2,800 monthly. A daily reporting service to company offices has been added as a bonus. Operating costs have been reduced nearly 50%.

Saving . . . A big saving for companies hiring contract work stems from a time-labor ratio. Men doing the field work spend only the hours needed to handle a particular assignment and then go to another job.

Under a typical pumping contract, the company pays $40 a month for pumping services if 16 or more operating days per calendar month are required. The fee is $20 when 15 or fewer operating days are required, and $10 when wells are inoperative or shut in.

Fees involving the use of equipment are varied.

One contractor charges $7.50 an hour for a double-drum unit and operator, plus $2 an hour for floor men.

Charges for roustabout pushers are $2.50 an hour and roustabout laborers are contracted for at the rate of $2.25 an hour. A charge for transportation and routine work tools averages $1.50 an hour.

For cable-tool services, companies pay $10 an hour to obtain a spudder, driller, tool dresser, and fuel. A moving charge of $100 an hour for equipment replacement is common.

There are standard charges for pumping-unit installations, mechanical ditching for flow lines, salt water disposal or water-flood systems, spray painting and other construction and maintenance operations.

Partial jobs . . . Some companies have been reluctant to give full operational responsibilities to a contractor.

The contractors, however, usually have been able even to sell these companies a variety of smaller services. Contracts to provide relief or part-time pumper service usually is the opening service.

In one area, a contract relief pumper is busy 6 days a week doing work for four companies. He serves as a relief pumper 3 days for three Gulf Oil Corp. workmen and as a one-day a week relief for Pure Oil, Texaco, and a smaller operator.

The contract relief pumper covers days off, holidays, and vacations of the regular company-hired pumpers. If a regular pumper works overtime, he is entitled to time and a half. Holidays bring a wage scale 2½ times regular pay, and pumper wages are in the $2.20 to $3.25 an hour range.

It's often flexibility of the contractor's services that makes him attractive. Some companies contract for gaging and well reports daily, others weekly or monthly. A few contracts call for roustabouting and well servicing only. Many specify pumping services and general lease housekeeping.

The contractors feel they are carving a niche for themselves by offering to take over routine field operations. The next step may find contractors operating whole units. There's a strong possibility that one unitization project now being formed may be submitted for bids on contract operation of the whole unit.

Typical Firm Aims at Volume

OILFIELD SERVICE, INC., with offices in Tulsa, Drumright, and Pawhuska, Okla., typifies the contract-service organization.

Its first contract, 5 years ago, was to serve a joint venture operation in Oklahoma, owned by a California-based major oil company and a nonresident investor. Now Oilfield Service handles more than 400 wells under contract, on 190 leases in two states.

Among its services the firm offers roustabouting and pumping work, limited engineering, general well servicing, and clerical help of various kinds.

"We'll take on the full responsibility for a field, or we'll hire out to do just one assigned job," says L. B. Jeffers, president.

Jeffers, a former engineer for a large production company, believes the No. 1 requisite for successful operation of a contracting service is volume. He has 80 workmen on full time and $250,000 in equipment ranging from pickup trucks to drilling tools.

A MODEL DERRICK and pumping well on display in the New York API office draws the attention of visiting Russian oil men.* The Soviets gave the model to U. S. oil men who toured Russia in August as a memento of their trip.

Touring Reds Sidestep Comparisons

• Brief sessions with the press show Soviet representatives aren't eager to compare what they have seen with what they have to offer in Russia.

THE RUSSIAN oil delegation, interested and alert, moved through the first week of its 4-week tour of the U. S. last week, obviously wanting to learn as much as possible about the U. S. industry.

Members of the delegation, mostly technical men, appeared eager to talk to their counterparts in this country. With reporters, however, they were cautious—friendly, but cautious—in the early stages of their trip.

They were careful to avoid saying that anything they had seen was any better than they had at home.

Their first oil stop, after arriving in New York, was the Tidewater refinery at Delaware City.

Arriving there at 11:30 a.m., they were briefed for 90 minutes by refinery officials, then lunched in the company cafeteria. The afternoon was spent touring the refinery, including the deep-water terminal.

They stayed until 5:30 p.m. and were reluctant to leave even then, expressing the hope that they could return for a further visit before they leave the country.

In Washington last Monday they were briefed by Interior officials on the duties of the Office of Oil and Gas, the Bureau of Mines' oil research projects, the activities of the U. S. Geological Survey, and the function of the Oil Import Administration.

They appeared to have some difficulty understanding the government-industry relationship, particularly the fact that the Government would undertake a research project up to a certain point and then turn it over to the industry to use.

Won't compare . . . At the close of the session, the chairman of the Soviet delegation, Stepan Ivanovick Kuvykin, made a short speech in which he stressed the importance of a wide dissemination of scientific knowledge. He said that science is for one and all, and he praised the exchange programs which permit scientists of one nation to share scientific knowledge with scientists of another nation.

Afterward, the Russians agreed—somewhat reluctantly—to a press interview. It was here that their reluctance to make Soviet-U. S. comparisons was evident.

For instance, they were asked about the Tidewater refinery. They replied that it was a "good" refinery, modern and up to date.

"It satisfies contemporary technology in the production of gasoline," their chairman said.

But, he said, there was no proper basis for comparison with a Soviet refinery because the Tidewater refinery was designed primarily to produce gasoline whereas Russian refineries cover a wide range of products, particularly the heavier products, to meet their particular product needs.

In this manner, he avoided saying the Tidewater refinery was any better than any in Russia.

Read the Journal . . . When The Oil

*IN THE PHOTO: Denis Nikolaevich Polyakov, section chief, foreign relations, department of state scientific technical committee, left; Stepan Ivanovich Kuvykin, chairman of Bashkir Sovnarkhoz (economic council) and chairman of the Russian delegation; Boris Sergeevich Semenov, engineer technologist, All Union Scientific Research Institute Oil Industry; Imran Musaevich Musaev, head engineer, Azneft combine; Gennadi Konstantinovich Maksimovich, specialist on oil mining, USSR Economic Council; and Lev Andreevich Gvozdetski, scientific worker, USSR Academy of Sciences Oil Institution.

and Gas Journal was mentioned, many of the delegation smiled and nodded vigorously, indicating they were familiar with the publication. The chairman said that each week a minimum of 500 copies of the Journal is reproduced by photographing the pages and distributed to their oil officials.

One Russian who could speak a little English said, smiling: "Yes, yes! The Yellow Book. Big and fat. Very good."

Aside from oil, the Russians obviously were impressed with the sights they saw in New York and Washington, particularly the heavy traffic.

The chairman said he liked Washington better because it was not so big nor so noisy.

Head for Texas . . . After Washington, the group flew to New Orleans for a visit there, including a trip to a Continental Oil Co. offshore operation. They were scheduled to visit a Cities Service refinery at Lake Charles, La., last Saturday and were due in Houston for the week end.

While in Houston they are to visit a Shell Development Corp. exploration and production research lab and then fly to Austin for a visit with the Texas Railroad Commission.

They will leave Austin Thursday to go to Midland, where they will visit the Spraberry field, and will fly to California next Monday.

There are nine Russians on the trip. A tenth was scheduled but he became ill and had to stay at home.

Two Offshore Tests

. . . are planned in Texas on federal leases.

OFFSHORE Texas, which currently has one important well drilling, soon will have two more.

Shell Oil Co. and Continental Oil Co. are testing acreage they acquired at last February's federal lease sale.

Shell's first effort was spudded in August (OGJ, Aug. 29, p. 58) about 31 miles south of Galveston. It was drilling past 11,650 ft. last week and headed toward a 12,500-ft. projected depth. The hole, drilled on expensive acreage, in Federal Block OCS-228, is tight.

The second Shell test will be located in Block 236, 14 miles northeast of the Block 288 well, and will drill to 13,000 ft.

Continental's test off Texas will be made in Block 349, about 20 miles southwest of Block 288. Tidelands Drilling Co., contractor, will spud about November 1 with its Mr. Gus II. Projected depth is 8,000 ft.

watching WASHINGTON

Clyde La Motte

• FPC hopes to be more specific on pricing plan . . .

THE NEXT few months will be decisive for the Federal Power Commission in its efforts to chart a new course for gas-producer regulation.

If the commission is able to follow through with definite, specific guidelines to bolster the policy statement it issued at the time of the Phillips case decision, its chances of establishing an acceptable pattern of regulation will be greatly improved.

If, however, it does not move forward in a positive manner, after having taken a tentative step, there will simply be more confusion than ever and the backlog of cases will pile higher.

The commissioners are acutely aware of this danger of delay, and their intention is to follow their initial move quickly with more explicit policy statements.

Look for the first of such statements in a month or so.

• CATC case may be used to set offshore prices . . .

IT IS LOGICAL to assume that one of the major moves the FPC will make soon will be to establish an area price for new gas sales in southern Louisiana, including offshore gas.

In its initial establishment of area prices, the commission did not specify a price for new sales there because, it pointed out, the CATC case is still in the courts.

However, because of the importance of this area and because of its potential, it is likely that the FPC will seek to set some general price guidelines, at least.

A great deal of evidence has already been taken in the CATC case, so it is a good bet FPC will use that data as the basis for a price ceiling.

If so, it probably will give other interested parties an opportunity to present their views on any proposed area price. The commission would then be ready to make a final decision.

In effect, the CATC case could very likely become the test case for the entire area-pricing approach, particularly since area pricing was not applied in the Phillips case.

• Democrats "explain" party view on depletion . . .

NOTE THE TIGHTROPE walk the Democrats are doing on the issue of percentage depletion.

In their party platform, they spoke out against tax loopholes. Depletion was not specifically mentioned. But since then, some Democrats, led by Sen. Lyndon Johnson, have been pointing out that percentage depletion applies not only to oil but to more than 100 other minerals. Neither Johnson nor anyone else in the party has specified which one is inequitable, although Johnson has indicated some inequities may have developed when others than producers of raw materials have been able to benefit from percentage depletion.

Nor was Sen. John F. Kennedy any more specific when the question was raised during a recent televised "debate" between him and Vice President Richard Nixon.

Kennedy said he thought all applications of percentage depletion, including oil, should be gone into thoroughly. Kennedy sought to soften this somewhat by remarking that the oil industry has recently had some hard times, and that this was particularly true of smaller producers.

A few days later, the natural-resource committee of the Democratic Advisory Council issued a special report which also called for a review to make sure that all minerals "get fair treatment."

Too, the policy group urged "strict regulation" of electric and gas utilities, and made it clear it would not favor exemption of gas producers from federal control.

Meanwhile, Nixon said flatly that he favors percentage depletion—at its present rate—to stimulate exploration and production.

Heavy Oil Looks Good as Blast-Furnace Fuel

ATTENTION of North American steel men is focused on a series of special pipe nozzles installed in the side of a Hamilton, Ontario, blast furnace.

The nozzles are physical evidence of a joint experiment by Dominion Foundaries & Steel Ltd., Imperial Oil Ltd., and Esso Research & Engineering Co. to determine whether heavy fuel oils can be burned in blast furnaces.

If the experiments are successful —and Imperial and Esso Research are confident that they will be—it will mean increased efficiency for steel makers at a time when they are facing mounting costs and competition.

A small test, the first in North America to be conducted with oil on a full-size blast furnace, was carried out successfully at the Dofasco plant beginning July 21. A large-scale test, using a new Dofasco furnace, is planned this fall.

Called hydrocarbon injection, the process consists of using fuel oil to provide part of the heat and gases to change iron oxide into iron.

Fuel oil is injected into the furnace through a special nozzle running inside each of the blow pipes through which hot air is fed.

The appartus is designed to be installed without shutting down the furnace.

Since the process makes room for additional ore and limestone inside a furnace, steel makers may enjoy immediate production increases without building new furnaces. A new furnace costs about $10 million and related facilities cost an equal amount.

The principle of hydrocarbon injection has been known for 75 years. But little has been known about many performance factors.

Esso Research & Engineering began studying the process over 2 years ago — conducting economic studies, talking to steel men, and feeding blast-furnace performance data into computers.

A year ago, Imperial and Esso Research began discussions with Dofasco and undertook laboratory studies of nozzle designs. Meanwhile, Esso Research had set up a hot-model unit—a pilot plant 20 feet high and 3 feet in diameter which simulates key blast-furnace conditions.

The hot-model unit showed that the process was simple, straight-forward, and had no apparent "bugs."

Pilot tests still had to be confirmed, and the July 21 tests at Dofasco provided the needed confirmation.

At that test, however, oil was injected through only one blow pipe. In the test this fall, oil will be injected through all blow pipes.

Miscible Drive in Neches Pool Sought

HUMBLE OIL & Refining Co. plans to launch a full-scale miscible drive in the Neches pool.

Field operators already have approved a unit agreement and now are in process of gathering signatures from royalty interests.

The Neches Sub-Clarksville reservoir in Anderson and Cherokee counties is a thin blanket-type sand which partially overlies the more prolific Neches Woodbine field. The sand is approaching primary exhaustion.

Production has dropped from a peak of 3,000 bbl. a day in 1955 to only 300 bbl. daily.

Field producers, with Humble as operator, will employ the Humble-pioneered condensing-gas drive with complementing water injection to reap a second oil crop from the pool if unitization is approved. The miscible drive will be expensive, Humble says, but will produce enough added oil to more than meet the added costs.

Plans call for buying and injecting more than 2,000,000 bbl. of propane. The cost of the propane alone is estimated at around $4.5 million.

The miscible drive is expected to recover about 5,000,000 bbl. of added oil from the reservoir.

Field operators are pointing out to royalty owners that they will receive about $2,000,000 in increased net income if the program goes through.

Before it can be started, 80% of the royalty owners must sign and the Texas Railroad Commission must approve.

INDUSTRY BRIEFS . . .

Continental Oil has failed in its third try to confirm a discovery on its Culver City tract in West Los Angeles. The company abandoned the Culver City Unit B-4 last week at 10,358 ft. The well, located in Sec. 7-2s-14w, is the company's third attempt to confirm its 720-bbl. discovery on the M-G-M movie lot.

Western Gulf Oil Co.'s name has been changed to Gulf Oil Corp. of California. Western Gulf handled all of Gulf's production and exploration activities on the West Coast. Gulf's refining and marketing is handled by another subsidiary, Wilshire Oil Co.

The Third Court of Civil Appeals in Austin has set for November 30 the State of Texas' appeal of a district court decision which held its severance-beneficiary tax on gas unconstitutional. About $7,500,000 a year in tax revenue is at stake—mostly from gas pipelines. Nearly all payments have been protested since the tax became effective in September 1959.

Amurex Oil Co.'s interest in the Hatton gas field, Saskatchewan, has been sold to Saskatchewan Power Corp. for $1,937,212. Murphy Corp. of El Dorado, Ark., owns about 80% of the stock of Amurex. A Murphy subsidiary, Murphy-Canada, also sold its interest in the field to Saskatchewan Power for $415,117.

The 10-story Shell Oil Co. office building in Tulsa has been sold by Shell to Futterman Corp. Shell leases the majority of space in the building, which was erected in 1957 by the Sunflower Corp. Other tenants include Bethlehem Steel and American Cyanamid.

Ammco Oil Co. has formally changed its name to Wacker Oil Co. and has moved its headquarters from Houston to New Orleans. The company, which has been operating largely in Texas, recently announced successful completion of its first venture in Louisiana—a producing oil well in Ascension Parish that was tested at 192 bbl. per day.

Smoke-pollution studies sponsored by Oil Heat Institute of America are now under way at Michigan State University. A complete study will be made of the chemical composition of smoke from oil burners.

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Halbouty Lauds Rockies for Conserving Oil

• Houston independent slams home state for permitting too many wells to be drilled. He claims compulsory unitization is the best way to conserve oil and says such a law is sorely needed in Texas.

THE State of Texas, which lifted the banner for conservation back in the 1930's, is a notable laggard today behind the newer oil-producing states of the Rocky Mountain region.

This was the message carried to Denver last week by Michel T. Halbouty, a Houston independent who has been shooting barbs into the Texas Railroad Commission for the past year for its failure to eliminate what Halbouty believes to be unnecessary drilling.

Halbouty's speech to the annual meeting of the Rocky Mountain Oil & Gas Association was remarkable for its praise of the conservation policies of the nonprorating states and his harsh criticism of his home state, which has limited production to market demand for many years.

Halbouty made a distinction between proration and market demand. If there were no drilling of unneeded wells, there would be no need for proration. It was this excessive drilling which made it necessary to prorate in Texas back in the 1930's. Fortunately, the conservation laws of the newer producing states of the Rocky Mountain region have encouraged larger drilling units and staved off the need for limiting production by law.

"Your laws are newer and better than ours in Texas," Halbouty said.

"The great oil producing states of the Southwest and Mid-Continent areas may be excused for some of their ridiculous conservation regulations on the basis that most of such practices were inherited . . .," Halbouty said.

"What I criticize in those states, and especially in my own State of Texas, is that while Texas, along with Oklahoma, is the birthplace of effective conservation, the state has not really progressed in its conservation laws. We are still regulating 1960 conditions under laws put on the books in the 1930's."

Halbouty said he was in full agreement with Chairman C. R. Henderson of the Utah Oil & Gas Commission, who said recently that Utah would rebel against any suggestion that Utah should restrict production in its wells to the level of a state where more than half the wells are drilling on less than 20-acre spacing.

However, the Texan suggested to the Rocky Mountain states that they would be foresighted to put market-demand legislation on the books today for future use when, and if, it is needed to prevent above-ground physical waste.

Michel T. Halbouty
. . . "your laws are better than ours."

Urges unitization . . . "Obviously there is no such need today," he said. "But if you wait until it is actually needed in the public interest, the difficulty in passing such a law would be far greater than it is now."

Halbouty suggested also to the Rocky Mountain states that they would do well to enact compulsory pool-wide unitization laws, although he made the recommendation with reservations and said that voluntary unitization has generally worked well in the region.

"So long as good voluntary unitization is practiced, there is no serious need for forced field-wide unitization," he said. "Only abuse can make such a controversial law necessary, and these abuses can be eliminated by the state agencies imposing proper rules and regulations on the guilty operators."

Compulsory unitization, he said, is sorely needed in Texas, where only 137 units have been formed in the state's history, compared with 197 in Oklahoma, a state with far less production but with a 14-year-old unitization law.

Praises states . . . Halbouty had his choicest words of praise for the states of Colorado, Nebraska, and Utah, which have "the most important conservation law of all—a law to prevent the drilling of unnecessary wells."

"Such a law, in my humble opinion, supersedes every other law on the conservation books."

Other states of the area, as well as his own Texas, should have one, he urged.

"Unnecessary wells are a curse imposed on the people of this nation who trust the petroleum industry to protect our natural resources of oil and gas," Halbouty said.

Part of the blame for the excessive wells in Texas must be placed on "the antiquated 20-acre spacing law." Blame also must be laid to "a little joker we call an exception to Rule 37, or the spacing law."

Halbouty said the Railroad Commission holds, under the exception, the "erroneous view" that an owner can drain his neighbor's property in order to make a profitable well. Each property owner is entitled to one well on his property regardless of its size.

PROCESSING

Sinclair Refining is closing three units at its Corpus Christi refinery. The units are a 12,000-bbl. Houdry catalytic cracker, a 3,000-bbl. thermal cracker-visbreaker, and a 1,850-bbl. alkylation unit. The refinery will continue to operate its 30,000-bbl. crude-catalytic reformer combination unit. The refinery will no longer produce aviation gas and solvents and will reduce its work force.

Tidewater Oil Co. and Collier Carbon & Chemical Corp. will build a 100 million pound per year naphthalene plant at Tidewater's Delaware City refinery, instead of one half that size. The two companies also are actively considering another joint-ven-

TGT Buys Renwar

. . . assets. Production in four states is included.

TENNESSEE GAS Transmission Co. has taken over the assets of Renwar Oil Corp., Dallas, for a net price of about $13.4 million.

The deal confirmed a report of last July that Tennessee Gas was negotiating for the Dallas independent (OGJ, July 4, p. 73).

Tennessee Gas acquired Renwar's assets in exchange for 800,000 shares of common stock, which sold last week at 21⅛. Although this amounts to a total of $16.9 million, the assets of Renwar included $3.5 million in cash. The net, therefore, was $13.4 million.

To operate the Renwar properties, Tennessee Gas established a new subsidiary, Tennessee-Texan Oil Co. which will operate under the Tennessee Gas & Oil Co. division.

Renwar had only three stockholders. None will remain with Tennessee-Texan. They are Roland S. Bond, president, and D. W. Forbes, secretary-treasurer, both of Dallas; and Guy I. Arren, vice president and general manager, Corpus Christi.

Among Renwar's assets are leasehold, royalty, and fee interests in 27,750 net oil and gas producing acres and 360,659 net undeveloped acres. The producing acres had 192 net oil and gas wells (721 gross) with a net daily average production of 2,200 bbl. of oil and 27.9 million cubic feet of gas.

Most of the production is in South Texas. The rest is in Louisiana, Oklahoma, Illinois, and western Canada. Interests are held also in Alaska, Michigan, Ohio, Spain, and Guatemala.

Canadian Gas Flows

. . . into northern part of Midwestern's system.

MIDWESTERN Gas Transmission Co. has started moving western Canada gas into its upper middlewest system on the basis of a 6.5% rate of return in the third year of operation. But the company has gone to court asking for 7%.

The company, a subsidiary of Tennessee Gas Transmission Co., is receiving gas into its 559-mile $52-million system from a spur line of the Trans-Canada Pipe Lines, Ltd.

Although the Midwestern line is designed to handle 204 million cubic feet of gas daily, it is taking something less than this at the start and will build up to the design figure in the third year of operation.

Deliveries actually began about 2 weeks ahead of the November 1 starting schedule. Michigan Wisconsin Pipe Line Co. will take about three-fourths of the deliveries.

Meanwhile, at New Orleans, the Fifth Circuit Court of Appeals is studying a petition from Midwestern asking that the 6.5% ruling of the FPC be reversed.

Midwestern also had sought, without success, to get FPC approval of rates which would grant a 7% return with the understanding that a refund would go to customers in the event the 6.5% rate is upheld in the courts.

Change in Rockies

. . . made by Socal in move to merge subsidiaries.

STANDARD Oil Co. of California has taken the first step in merging activities of four subsidiaries by creating a new organization to operate in the Rocky Mountains and Central Plains states.

Socal has organized California Oil Co. to handle duties formerly coming under four subsidiaries: The California Co., New Orleans; Standard Oil Co. of Texas, Houston; Salt Lake Refining Co., Salt Lake City; and the old California Co., which operates on the East Coast.

Under the consolidation, a new organization, California Oil Co., Western Division, will handle all operations in the Rockies and adjoining area from headquarters in Denver. Apparently other divisions will be established later to cover other parts of the country.

F. C. Loomis, formerly a vice-president of Western Operations, will be president of the new division headquartering in Denver. C. M. Tuller, formerly vice president of The California Co., will be vice president and general manager of marketing and supply.

Other officers in the new Western Division include: M. P. Paret, Jr., vice president-El Paso; P. N. Johnson, vice president-Salt Lake; J. H. Todd, vice president - Exploration, production-Denver; and Dee Davis, vice president, secretary, and treasurer-Denver.

BRIEFS . . .

ture naphthalene plant for the Los Angeles area.

Three UOP Merox units have been started up by Standard of Ohio. A 12,000-bbl. per day unit at Toledo, used for sweetening light catalytic gasoline, is one of the largest applications of the UOP treating process ever placed on stream. A Merox unit at Cleveland is sweetening 1,000 bbl. of light catalytic gasoline daily, while another Cleveland unit is extracting mercaptans from between 500 and 7,100 bbl. of mixed butanes daily according to seasonal demand.

A $17-million complex of chemical plants will be started soon at the Richmond refinery of Standard of California. The complex will produce enough paraxylene, a petroleum chemical raw material, to boost Richmond's annual output by 41 million pounds. In addition, the facility will provide more than 100 million pounds of high-purity orthoxylene annually.

Signal Oil & Gas is moving its research and development headquarters from Houston to Los Angeles. Dr. A. S. Kasperik, head of the department, is slated to make the move November 1 along with some members of the 35-man department.

A high-purity benzene plant will be constructed by Phillips Petroleum Co. at its Sweeny refinery south of Houston. Design capacity of the plant is 22 million gallons per year and shipments are expected to begin by mid-1961.

Also for Refiners . . .

IN THE NEWS: Railroad Commission holds Texas allowable to 8 days for seventh consecutive month (p. 61) . . . Esso Research may have breakthrough on using heavy fuel oil in blast furnaces (p. 72) . . . Shell's big West Coast polyisoprene plant goes on stream (p. 77) . . . New York bankers see tremendous growth in oil demand abroad (p. 80).

PLUS THESE TECHNICAL REPORTS: A special 18-page section on refinery maintenance (pp. 85-103) . . . Underground ammonia storage has disadvantages (p. 127).

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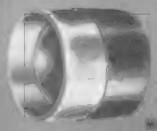

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60—300

First Big Polyisoprene Plant Goes on Stream

SHELL CHEMICAL CO. has officially opened the nation's first major commercial polyisoprene plant at Torrance, Calif., in a bid to capture a share of the natural-rubber market.

The company says Torrance units now can produce about 40 million pounds a year of the manmade equivalent of natural rubber. This is a tenfold increase over pilot production started in March, 1959.

For the past 17 years the Torrance plant has produced a general purpose synthetic rubber which will continue to be its principal product for some time. This and other synthetic rubbers made in the U. S. have accounted for about 66% of all the rubber used in the country.

Natural rubber imported from other nations has made up the remaining 34%. It has been preferred for certain uses, such as heavy-duty truck tires and airplane tires.

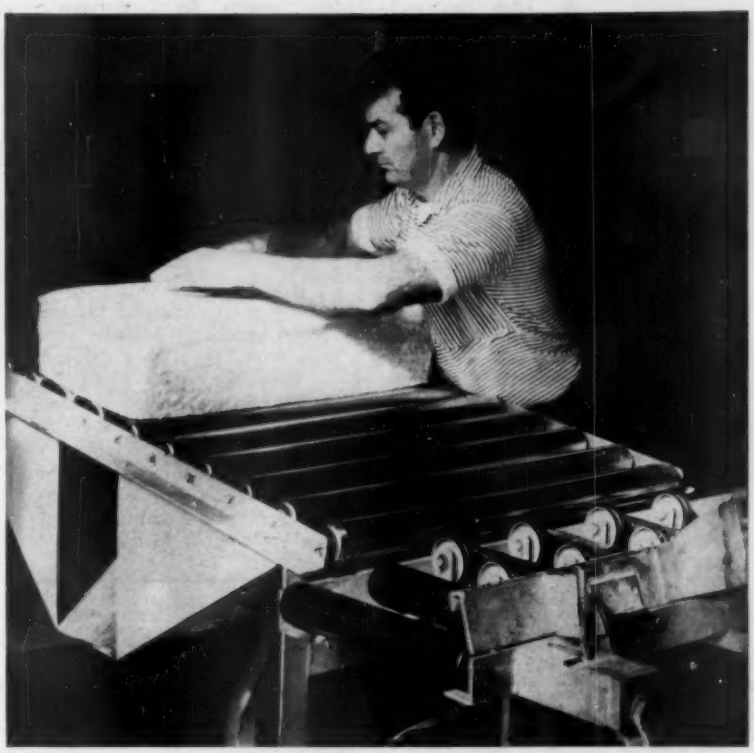
Shell Chemical officials say their new product, called Shell Isoprene Rubber, can replace natural rubber in these and many other end uses.

The company surprised the rubber industry last year with its announcement that it had started producing 5 tons of polyisoprene a day in a pilot plant.

Several other companies have revealed plans to enter the polyisoprene field commercially (OGJ, May 16, p. 99).

Polyisoprene, an oil-based material almost identical to natural rubber and much cheaper, is a product of the polymerization of isoprene, a hydrocarbon that can be converted from a refinery's C_5 stream. Feedstock for the Torrance plant comes from a Shell Oil refinery nearby.

Cost of the synthetic is about 30 cents a pound, compared to natural rubber's 38 to more than 40 cents.



A BALE of Shell Isoprene Rubber undergoes an examination as it comes off the assembly line at Shell Chemical's expanded plant in California.

In addition to the Torrance installation, Shell Chemical has announced plans to build a second polyisoprene plant of 80 million pounds a year capacity near Marietta, Ohio.

Goodrich-Gulf Chemicals is working on a 25,000-ton polyisoprene plant with completion scheduled for next year. Firestone Tire & Rubber Co. plans to complete a 30-000-ton polymer plant at Orange, Tex., in January.

Goodyear Tire & Rubber Co. operates a pilot polyisoprene installation at Akron, U. S. Rubber has reportedly shown interest in building a plant, and Humble Oil & Refining Co. has produced some polyisoprene at its Baytown butadiene facility.

In the first quarter of 1960, the nation consumed 560,000 tons of natural rubber. With that as a basis, the planned capacity of polyisoprene could account for 25% of the domestic market for natural rubber and make polyisoprene the third biggest of the general classes of synthetic rubber. The S-rubbers and neoprene would outrank it.

Yukon, Alaskan Wildcats Dry

THE NORTHERNMOST well on the North American Continent, Amerada Petroleum Corp. et al. 1 Y.T.-A, has been abandoned as a dry hole.

This disappointment in the northern area of the Yukon shared the exploration spotlight last week with another dry hole in the north country—a duster drilled by Union Oil Co. and Ohio Oil Co. in the Knik Arm area of Alaska.

The Yukon well was taken to a total depth of 8,004 ft. before being abandoned by Amerada, the operator. Ohio and Hudson's Bay Oil & Gas Co. also possesses an interest in the well.

The test is 60 miles north of the Arctic Circle at 67° 19′ 45″ N. and 136° 53′ 29″ W. The well was spudded February 29 after the operator spent considerable time and money preparing a site and getting equipment to the remote location (OGJ, Aug. 1, p. 204).

Alaska well . . . The Union-Ohio wildcat is the first of three holes the companies will drill at Knik Arm.

The dry well, 1 Knik Arm, was abandoned at 3,103 ft. A hole of about the same depth is being drilled to the west about 2 miles (OGJ, Oct. 10, p. 114). Last week, the second well was drilling below 503 ft. The two wells are 18 miles northwest of Anchorage.

Union and Ohio have established commercial gas production about 150 miles south of the Knik Arm test on their holdings on the Kenai Peninsula.

Transwestern Knocks Proposed Gas Line

• The project—from Texas to California via Mexico—is uneconomic, the company says. Transwestern claims southern California's gas needs can be satisfied with its new line from Texas to the West Coast.

ONE THING for certain: The proposed Texas-Mexico-California gas pipeline will have many rivers to cross before it ever lays a section of pipe.

Despite the array of big names behind it—Tennessee Gas, Pemex, Southern California Edison, and Humble—opposition to the $225-million project will be active and loud.

Last week Transwestern Gas Pipeline Co. added its voice to the storm.

Transwestern's competitive position is threatened by the proposed new supply of gas for the Southern California market, and President Mills Cox let the public know about it.

The proposed project is not economically feasible at this time, Cox said, and it can't expect to get approval of federal and state agencies.

If Southern California needs more gas, Cox added with some feeling, it need look no further than Transwestern's brand new Texas-to-California line, which can move 150 million cubic feet of gas daily more than is now being moved. In fact, Transwestern has offered to move this extra amount and thus cut its rate materially—but the offer was not accepted.

Transwestern's opposition is supported on the California end by Pacific Lighting Gas Supply Co. which earlier went on record against the line. Southern California Edison is Pacific Lighting's best customer—and Pacific Lighting wants to keep it that way.

The quiet proponents . . . Principals in the proposed international line are keeping a discreet silence in the face of the attacks. They prefer to do their arguing before the agencies which must grant authority for construction of the line.

All four companies have a specific interest in building a new line in preference to using one already in existence. Tennessee Gas Transmission Co., the moving force behind the line, has always wanted to go west—and this is its chance.

Petroleos Mexicanos, the Mexican oil agency sees the chance to get a foreign-financed line within its own borders and sell some of its own gas to the United States.

Southern California Edison Co. wants an assured source of gas at a steady price. And Humble Oil & Refining Co. wants to sell its South Texas gas to a single buyer like Edison and perhaps be spared the pains of FPC price control.

Touchy timing . . . There has been considerable irritation on the part of Transwestern and Pacific Lighting officials concerning the proposed line through Mexico.

One reason for the irritation involved an incident of timing. Tennessee Gas and Southern California Edison announced their agreement to build the Mexico line on the same day that Transwestern was receiving an official welcome to California by the Los Angeles Chamber of Commerce (OGJ, Sept. 26, p. 106).

No one suggested that the unfortunate timing of the announcement was by design—but it did call attention to the rugged competition for the southern California gas market that Transwestern faces.

Transwestern's Cox did not state what his company will do specifically to halt the Tennessee Gas project, but it was taken for granted that Transwestern will intervene in any application that is made to federal agencies for approval of the line.

Cox said Transwestern's line is built to increase deliveries of gas with little additional investment, and the cost of moving the gas would be "much below that of the proposed Mexican venture."

"Not only would the transportation cost of this additional gas, if transported by Transwestern through its existing facilities, be lower, but also the cost of the gas now being sold by Transwestern for distribution to southern California would be reduced."

The Mexican line also has the disadvantage of making southern California further dependent on foreign gas for future energy, Cox said.

Line into Mexico Needs short name

HAS ANYBODY got a handy short name for the proposed south-of-the-border pipeline from Texas to California?

Tennessee Gas, which had the original idea for the line, has no name for it. Some industry people are referring to it as the "Enchilada Line" but Tennessee Gas is not encouraging the name because it might not set well in Mexico.

PIPELINE BRIEFS . . .

Proposed merger of Northern Natural Gas Co. and its subsidiary, Permian Basin Pipeline Co., already approved by the directors of the two companies, will be decided by stockholders November 30. Northern owns 93.2% of Permian's common stock and 57.9% of its preferred. Permian, organized in 1950, gathers gas in West Texas and New Mexico for delivery to Northern's system at Sunray, Tex. Northern distributes gas as far north as South Dakota and Minnesota.

Calnev Pipe Line Co. will build a 225-mile pipeline from Colton, Calif., to Las Vegas, Nev., to carry 16,000 to 18,000 bbl. per day of gasoline, diesel fuel and jet fuel. Cost is reported to be just under $10,000,000. Products will come from Southern Pacific Pipe Lines, Inc., which has a station at Colton. The line will serve Victorville and Barstow, Calif., and Nellis Air Force base. The first 212 miles will be 8-in. and the last 13 miles, 6-in. Union Pacific Railroad is the majority owner of Calnev. Williams Brothers is the contractor and will begin construction this month.

Mid-Continent Pipe Line has acquired the Earlsboro gathering system in Seminole and Pottawatomie counties, Oklahoma, from Service Pipe Line. The system consists of 30 miles of various size lines and gathers about 500 bbl. of crude daily from 45 leases. The crude will be picked up at the Seminole station of Mid-Continent and

Soviets Pushing Ambitious Oil Plans

• U. S. official predicts Russian capabilities will broaden greatly in 7-year drive. A big rise in exports is certain.

RUSSIA is not only stepping up its crude-oil production substantially but has equally ambitious programs under way to improve and increase refining capacity, add storage facilities, and build more pipelines and tankers.

This outlook for the Soviet Union was outlined recently by Donald J. Frendzel, of the Division of Foreign Activities in the Bureau of Mines.

Frendzel's observations were based on his detailed studies of Russian oil publications and other sources of Russian oil data.

He presented the results in a speech at the petroleum seminar in Washington during the annual convention of the Quartermaster Association.

The report bore out many of the findings of the U. S. oil delegation that toured Russia, and also supplied considerable detail about Soviet oil.

Alexander Gakner, eastern European specialist in the Division of Foreign Activities and a member of the U. S. delegation to Russia, also spoke briefly at the seminar.

Gakner emphasized the impression he gained on the trip that the Russians set great store on meeting the goals of their 7-year plans. Thus, their targets are not to be taken lightly.

Outlook for 1965 . . . Frendzel concluded in his report that by 1965—the end of the current 7-year plan—the Soviet oil capability will have increased greatly.

He noted these factors in particular: Production is scheduled to run well ahead of domestic demand, natural-gas output is to increase sharply and thereby free some of the demand for oil, pipelines are planned to eastern European satellites and to the Baltic, and a number of oil tankers are on order or are being built in satellite and free-world yards.

Frendzel predicted that by 1965 the Soviets could more than double the 1959 level of exports to the free world. He noted that Brazil, Ghana, Lebanon, Republic of Guinea, and Tunisia all received their first Soviet oil in 1959, and that Cuba and India were added to the list in 1960.

Frendzel said the Soviets are eyeing Canada, Ceylon, and Ethiopia as possible customers in the near future.

Refining . . . The Soviets plan to more than double primary distillation capacity during the 1959-1965 period.

By 1965, the Soviets hope to more than quadruple catalytic-cracking capacity and to step up catalytic reforming 16 to 18 times. Lube-oil processing is to double.

Storage . . . Frendzel has come across complaints in the Soviet press indicating that storage capacity is not being built fast enough to keep pace with the huge increases in crude-oil products production.

But, Frendzel said, these critics have been told that the Soviets plan to complete a considerable amount of new storage this year.

He said the trend in storage construction will be toward greater use of reinforced concrete tanks. The Soviets are concentrating on tanks with floating and breathing roofs in the hopes of cutting the 1958 rate of transportation and storage losses in half by 1965.

Pipelines . . . The Soviets plan to increase crude and product pipelines three-fold by 1965. And this increase may play a major role in any stepping up of oil exports.

For instance, one line being planned is to the Baltic, thus strengthening the competitive position of the USSR in the Scandinavian market and in other parts of Europe.

Another line, to eastern Europe, may be extended ultimately into West Germany. If so, Russian oil could become a much bigger factor in the European oil picture.

Tankers . . . Although the Russians are currently taking advantage of the world surplus of tankers to move exports at low charter rates, they are expanding their oil tanker fleet as rapidly as possible.

The aim is to have more ships under the Russian flag to protect against future charter embargoes which would limit their shipping ability.

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delivered to the Tulsa refinery of the parent company, DX Sunray.

Gas Trunk Line of British Columbia has completed the first 52-mile section of the system which will gather gas in northern British Columbia for Westcoast Transmission. The first section connects the Buick Creek and Laprise Creek fields. Another section, 30 miles of 16-in. line, will be built before winter to the Boundary Lake field on the Alberta border.

Acquisition of Trans-State Pipeline Co.'s crude-gathering facilities in the Heidelberg-Eucutta-Yellow Creek fields in south Mississippi has been announced by Hess Pipeline Co. Transfer of the properties will be completed by the first of the year. Hess earlier acquired the trunk line from the fields to Mobile, Ala.

Pipe laying is scheduled to begin this month on Seadrift Pipe Line's dual, 56-mile 6-in. products line from Bay City to Seadrift, Tex. The dual line will permit the company to handle different products simultaneously. Contractor is Sharman, Allen, Gay & Taylor, Houston.

Pacific Gas Transmission has let what is perhaps the largest contract ever made for double jointing. The contract, calling for double jointing and yard treating of 466 miles of 36-in. pipe, has been let to Stanley-Bledsoe Corp. Locations will be at Sprague River, Gilchrist, Madras, Condon, and Hinkle, Ore., and at Elwood and Winona, Wash. The first four locations will double joint 313 miles of pipe and the last three, 153 miles.

Also for Pipeliners . . .

IN THE NEWS: Continental plans crude line to tap Montana fields (p. 60) . . . Imperial says moving western Canadian crude to Montreal uneconomical (p. 61) . . . Canadian gas starts moving into northern part of Midwestern system (p. 75) . . . Transwestern says there's no need to build new gas line to California by way of Mexico (p. 78).

PLUS THIS TECHNICAL REPORT: Automatic vapor-pressure instrument controls addition of volatiles into crude lines (p. 108).

Energy Patterns Abroad . . . oil is the leading source.

(Countries listed in order of energy use.)

DEVELOPING COUNTRIES	Percentage of total consumption, 1958				Million metric tons of coal
	OIL	COAL	GAS	HYDRO-ELECT.	TOTAL
With Major Oil Production					
Mexico	74.8	6.2	16.4	2.6	24.46
Argentina	83.6	7.5	8.6	0.3	23.11
Venezuela	67.3	0.2	32.4	0.1	16.12
Indonesia	66.0	5.9	27.4	0.7	10.13
Colombia	54.8	37.6	3.7	3.9	6.09
Iran	96.2	3.8	....	....	3.99
Iraq	99.6	0.4	....	....	2.61
Trinidad	39.0	....	61.0	....	1.46
Saudi Arabia	100.0	....	....	....	1.15
Kuwait	100.0	....	....	....	0.85
Other Countries					
India	16.7	82.1	....	1.2	54.63
Brazil	75.0	14.0	2.0	9.0	20.99
UAR	94.8	5.2	....	....	6.15
Chile	49.9	39.5	5.1	5.5	5.83
Pakistan	45.0	39.7	14.0	1.3	5.21
Malaya	98.2	1.1	....	0.7	2.69
Algeria	70.1	27.9	....	2.0	2.44
Nigeria	43.7	55.6	....	0.7	1.51
Congo	46.5	38.7	....	14.8	1.42
Morocco	69.5	22.5	....	8.0	1.38
Burma	63.3	36.7	....	....	0.98
Ceylon	75.9	21.7	....	2.4	0.83
Lebanon	97.4	....	....	2.6	0.78
Sudan	91.9	8.1	....	....	0.62
Tunisia	90.1	5.9	2.0	2.0	0.51
Bolivia	91.1	....	2.2	6.7	0.45
Costa Rica	85.7	....	....	14.3	0.28
Libya	83.3	16.7	....	....	0.24
Jordan	100.0	....	....	....	0.22
Nicaragua	95.0	2.5	....	2.5	0.18
Ethiopia	93.3	6.7	....	....	0.15

Bankers See Big Oil Demand Abroad

• Arab Congress is told that new markets for 30 million barrels daily may be provided by growing countries in Africa, Asia, and Latin America. They predict oil will provide most of the energy for these developing areas.

OIL will expand its role in the next decade as the mainspring of economic growth in the developing regions of Africa, Asia, and Latin America.

This will prove true whether the growth region has its own production or must import petroleum, two American experts told the Second Arab Petroleum Congress last week in Beirut.

The part petroleum will play in the economic development of these vast areas was detailed in a paper delivered by John L. Ivers, assistant vice president of the First National City Bank of New York. He was joined in the study by Edward Symonds, the bank's petroleum economist.

They defined the developing areas specifically as all of Africa and Latin America and all of Asia except Japan and the Communist-dominated areas.

Oil, according to the New York bankers, has many built-in advantages for these areas over other sources of energy: Adaptability, ease of transport, and ability to finance itself.

The present world-wide energy surplus won't last forever, they predict. The day will come when the developing regions will consume energy in volumes comparable to those in Europe now. Although these are still well below consumption levels in North America, they indicate a future additional oil market of 30 million barrels a day.

This potential market will give these emerging regions an immense importance as consumers of petroleum comparable to the importance that some of them have won as producers.

The present energy surplus, however, offers a challenge to the producing countries and to producing companies. The bankers say it means:

. . . **For producing countries**—Avoid attitudes or demands that could disturb a relationship with an industry from which they have greatly benefited. The position of petroleum could be easily undermined in meeting the competition of other energy forms—particularly in the existing mass markets in Europe and North America.

. . . **For producing companies**—Explore and expand new markets, particularly in the world's developing regions.

Magic medicine . . . There's an urgency among the emerging areas for faster economic development.

Old political ties often are broken. Traditional channels of financial and technical cooperation are dried up. Exploitation of mineral wealth has become a kind of magic medicine.

And often earnings from petroleum have provided a powerful stimulus. Oil revenues have given an outstanding advantage to any government embarking on a development program. Countries so endowed, however, still face many difficulties as recent history can testify.

Venezuela is an example. Its oil income reached $970 million last year and has been flowing in for a long

time. This has helped raise living standards to the highest in Latin America. Even so, the government has had financial problems in its economic development effort. It has resorted to higher taxes, cutbacks in investment, and borrowing abroad. It points up the danger of launching a development based on oil as a single source of funds.

Similar troubles have plagued Iran, Saudi Arabia, and Iraq. In Iran and Iraq, expenditures on development programs represent more than 90% of income from oil which in both instances exceeds $250 million annually. Even the leading oil-exporting countries have found that oil revenue will not insure development programs against obstacles and delays.

The bankers, however, explained that public development programs reflect only a part of a country's total economic activity, even where the government takes the lead in stimulating growth. The activities of private traders, investors, contractors have just as large an impact on local production and living standards.

The oil industries in these areas also play a role in stimulating private endeavors. Oil workers are usually among the most highly paid group of the population, and the industry is a large source of industrial employment. Local suppliers, contractors, and tradesmen benefit from these payrolls as well as from direct sales to the oil companies.

There also is a pitfall in this: An area may develop a "one crop" economy, depending solely on the oil industry. A pinch inevitably comes when world oil production or refining patterns change or the industry encounters slack periods.

The bankers stress that government oil revenues and direct oil company spending in a region should be used to speed up economic diversification. The oil benefits should be used to bring other resources into play and not merely as an addition to current income.

Oil is energy . . . Development in any area cannot even begin unless mechanical energy is plentiful and relatively cheap.

And the significance of oil in the developing regions is just as great as an energy supplier as a supplier of revenue.

About three-fourths of the power or heat needed for energy in the developing countries can be supplied from coal, oil, natural gas, or hydroelectricity. A major influence on what energy source is selected is the natural resources of the area and transportation possibilities.

The pattern of commercial energy consumption indicates that a few countries—notably India with its large coal resources—make little use of oil except where substitution is difficult or impossible. By contrast Argentina, Brazil, Ethiopia, Malaya, and many others with little or no domestic coal depend very heavily on oil.

Ivers and Symonds believe oil will continue to enjoy this preeminent position in the developing economies, and demand will grow strongly as development proceeds.

Countries with oil reserves recognize this and in increasing numbers are inviting the technical and financial resources of the international oil companies.

Countries without oil resources face the choice of developing other energy sources or relying on imports. The importing route imposes a drain on foreign exchange income and increases the pressure for self-sufficiency in energy.

In this drive for self-sufficiency, here is how oil stacks up with its rivals:

. . . Hydroelectric power—has a tremendous advantage if combined with flood control or irrigation measures. But in other situations, hydroelectric power is limited by distance, variations in head waters, and size of investment required.

. . . Nuclear power — has technical and financial obstacles that nearly count it out for many years to come.

. . . Coal — with simple processes and low capitalization is well adapted to conditions in developing regions if available. But coal loses this advantage if it has to be transported for any considerable distance.

. . . Oil—offers great transport advantages through supertankers or pipelines. Oil is now the largest commodity handled in international trade, and this trade represents one-third of the world's production.

Pipelines also are becoming increasingly important, especially product lines. A recent study, for instance, indicates that in Europe the minimum market requirement to make a product pipeline economic is 20,000 bbl. daily. Apart from its ease of transport, oil offers another special advantage because of the variety of products that it can supply.

. . . Natural gas—can expect a rapid growth in developing countries where supplies are available or accessible by pipeline. The gas offers a chance for local investment in power stations, cement, fertilizer, carbon black, and synthetic-rubber plants.

However, export markets must be reached with the gas if adequate use is to be made of volumes of gas that already have been discovered in the Middle East. In this connection, the experiments in shipping refrigerated methane by tanker are hopeful.

The investment burden . . . Investment requirements in the capital-scarce developing regions highly favor growth of oil as an energy source.

Other sources of energy usually require some heavy local investment or heavy borrowing. The oil industry, on the other hand, can be expected to bring with it much the greater part of the finance needed to discover, produce, and market the reserves of developing countries. There is little or no capital cost to the country concerned.

And the growth demands expected in the future underscore the massive capital needs for the petroleum industry.

Barring major upsets, oil demand in developing regions may grow at the rate of 7% a year over the present decade. This means a doubling by 1970 of present consumption rate of 2.8 million barrels a day.

In the past, an investment of about $3,000 has been required for each barrel of additional oil brought into production. Another $3,000 investment has been needed to refine, transport, and market this additional barrel of oil. This is a total investment of $6,000 a barrel for new oil coming to market.

On this basis, the bankers estimated the investment needs of the oil industry at $17 billion in this decade to create new capacity to feed markets of developing areas.

The bankers said that the oil industry can serve the developing regions with this investment "given equitable treatment of foreign investors and acceptable petroleum legislation."

They pointed out that many growing areas are unable to assume this investment burden themselves and that if the capital flow is shut out, their growth will be slowed down.

Next week

Oil in Europe

THE JOURNAL'S October 31 issue will feature 50-page report on all aspects of the booming oil and gas industry in Europe and North Africa.

The fast-rising demand, the new web of pipelines, expansion of plant capacity, and technological progress are put in sharp focus in next week's special Journal report on Europe.

Pressures in Middle East Don't Alarm Mobil

• Although there are serious problems, a company vice president says Mobil is confident about the region. He doesn't believe there will be any expropriation attempts or a change in the 50-50 profit split.

POLITICAL and economic pressures at work in the Middle East will not bring about drastic changes in oil company operations.

This is the view of W. E. Lindenmuth, Middle East region vice president for Mobil International. He told the Quartermaster Association in Washington that despite the various problems, Mobil's attitude about the region is "on the whole, one of confidence."

Included in Lindenmuth's list of political problems are:

. . . International politics. The Middle East countries, he says, want to be friendly with both East and West, and yet not wholeheartedly on the side of either.

. . . Attitudes of local governments. Because of their own political problems the attitude of some governments is "somewhat unpredictable."

However, Lindenmuth says Mobil doubts that any of the governments would resort to expropriation because they understand that their long-term interests would not be helped by such an action.

The economic problems which Lindenmuth mentions include the worldwide surplus of oil and tankers, the recent price cuts and competition.

Noting that the reductions in crude postings have stimulated talk of a change in the traditional 50-50 split in the Middle East, Lindenmuth says that Arab governments have done well under this arrangement and there is reason to believe they will continue to respect their contracts.

Also mentioned as a problem is the serious thought being given in the Middle East to the possibility of international proration. The obstacles to such a plan "would seem almost insurmountable," Lindenmuth says.

"In order for it (proration) to be effective, all the major exporting countries of the world must participate. And yet, if the Middle East and Venezuela do agree on even some limited method of restricting production in order to hold up prices, they may be able to exert a major influence on world supplies."

Record revenues . . . Despite the recent price cuts, Lindenmuth says that oil income of the producing countries in the Middle East will reach the record-breaking level of $1⅓ billion this year.

The ever-higher revenue is made possible by the increasing production rate. Although the gain in Middle East production this year was forecast at about 6%, the increase for the first 6 months was actually close to 11%.

The production increase reflects the terrific gain in free world demand this year. In Europe — the market place for two-thirds of Middle East oil—demand has been up 18 to 20% since the beginning of the year.

In the Far East, which takes about one-fifth of the area's production, demand is up about 17%, Lindenmuth says.

The amount of oil still in the ground in the Middle East is calculated at 114 billion barrels, the Mobil executive says. This is equal to 59% of the world's known oil—including that claimed by the Soviets.

New Arab maturity . . . A significant factor in the Middle East today is the growing knowledge and sophistication of Arab leaders, according to the Mobil official.

"We are dealing with people who have their own beliefs on oil prices and international markets," he says. "This means that they can, and do, drive a hard bargain with us. It also means that they are increasingly aware of the value of a good contract and, thereby, inclined to respect it."

Lindenmuth also notes that the oil business itself has undergone changes in the last few years.

Ten years ago seven international companies held more than 93% of Middle East reserves and world crude prices were generally stable.

Today, there are 27 private companies and five government-owned companies aggressively searching for oil or sharing in production in the Middle East. The combination of new companies in the area and new discoveries is affecting, or will affect, both markets and prices.

And he points out that an oil company cannot subsist solely on its investment in Middle East oil production. A company producing oil abroad, to get a return on its investment, must invest at least three times as much in other parts of the world to transport, refine and market the oil, Lindenmuth says.

Without this additional investment, companies could not expect to secure a return on their investment in the Middle East, nor could local governments expect to receive their present oil revenues.

Total oil company taxes, royalties, wages, and other expenditures in the area are about $2 billion a year, Lindenmuth estimates.

Strike Made Near Edjele

A WEST German company has an interest in the latest discovery in the French Sahara.

Gewerkschaft Elwerath has a 20% share in a find at Tan Emellel 1, about 12 miles southwest of Edjele oil field in eastern Algeria, near the Libyan border. A production test revealed a moderate flow of oil from 1,400 meters, or about 4,580 ft. in Cambro-Ordovician. Details were not revealed. Gas was encountered further up hole in a zone from 2,620-3,280 ft.

Elwerath's partners in the concession are Eurofrep with 70% interest, and Petropar, 10%. A 460-mile 24-in. crude pipeline from the Edjele area to the Mediterranean Coast of Tunisia opened this month.

FOREIGN

A maleic anhydride plant is being built by Rheinpreussen, A.G., at Hamberg, Germany, with an initial design capacity of 13.2 million pounds per year. Scientific Design has licensed the company to use its fixed-bed catalytic process for air oxidation of benzene and will provide complete process design and engineering.

In a joint venture, British Petroleum and California Chemical will construct two aromatics manufacturing plants in Europe. The $19.6-million undertaking will be called BP California, and the units will be located next to BP refineries in Kent, England, and in Dinslaken, West Germany. Initially the plants will produce 19,000 tons a year of orthoxylene, 16,000 tons of ethyl benzene and 22,000 tons of paraxylene, the basic ingredients of polyester synthetic fibers.

Oil Consumption in Europe

1959 INLAND USE IN '000 TONS

Country	Gasolines	Kerosine	Gas/Diesel Oil	Fuel Oil	Lubricants	Asphalt
Belgium	1,296.0	73.0	1,878.0	2,065.0	102.0	129.0
Luxemburg	49.8	1.3	91.7	35.1	7.2	2.9
Netherlands	1,371.0	471.0	1,865.0	2,996.0	103.0	175.0
Denmark	921.0	146.0	1,210.0	1,816.0	54.0	99.0
France	5,248.0	225.0	5,062.0	7,499.0	493.0	1,043.0
West Germany	5,331.0	55.0	9,118.0	5,444.0	613.0	1,212.0
Greece	146.7	117.0	563.0	738.0	24.0	42.0
Ireland	269.0	118.0	225.0	365.0	21.0	64.0
Italy	2,377.0	158.0	2,352.0	8,600.0	198.0	545.0
Norway	522.4	81.0	968.5	1,300.2	36.9	62.7
Portugal	197.4	151.6	294.5	402.5	26.9	22.4
Sweden	1,469.0	225.0	3,566.0	4,659.0	105.0	
Switzerland	885.9	79.4	1,568.9	559.4	51.5	102.2
Turkey	388.7	298.7	543.8	43.1	60.1	45.0
United Kingdom	8,226.0	2,264.0	5,485.0	14,039.0	942.0	1,007.0
Spain	831.4	350.0	978.2	2,146.4	98.3	93.3
Total	**29,530.3**	**4,814.0**	**35,769.6**	**52,708.6**	**2,935.9**	**4,644.5**

SOURCE: OEEC Oil Section.

Fuel Oil Fires Europe Economy

THE IMPORTANT role of fuel oil in the European economy is clearly indicated in new data from The Organization for European Economic Cooperation on consumption of oil products last year.

Of the total 52,708,600 tons of fuel oil consumed in the OEEC area in 1959, a total of 32,169,700 tons, or about 61% was used by industry as fuel in iron and steel manufacturing and for other industrial needs.

The next biggest market for fuel oil was in electricity production, which accounted for 8,164,700 tons. This source of demand required more oil than the domestic commercial lighting and heating market, where deliveries totaled 7,370,300 tons. Railways burned 1,728,100 tons, and inland waterways and coastal shipping used another 1,670,100 tons.

Town gas manufacture used 454,500 tons of fuel oil, agriculture, 27,200 tons, and unspecified and other power uses accounted for 1,122,000 tons.

Total consumption was further increased by the use of 10,613,200 tons of fuel oil as maritime bunkers. This, combined with inland demand, brought total consumption in western Europe to 63,321,000 tons.

Gas/diesel oil . . . The second-ranking product in the OEEC area was gas/diesel oil, which found its chief market in domestic and commercial lighting and heating. These end uses accounted for 11,222,800 tons.

Highway transport required 10,423,900 tons, inland waterways and coastal shipping used 2,412,400 tons, and railways 721,400 tons of gas/diesel oil. Industry took 4,412,500 tons, agriculture, 2,950,500 tons, electricity and gas making, 662,300 tons, and other power uses, 1,196,000 tons. Unspecified uses accounted for 1,767,800 tons. In addition to inland demand, another 3,547,600 tons was used as bunkers.

Gasoline sales . . . Highway transport accounted for 25,161,500 tons out of a total market of 29,530,300 tons. And of all motor gasoline consumed, premium sales represented a considerable fraction of the total.

Figures are not available for every country. But data in hand shows that premium gasoline in Belgium accounted for about 49% of sales; in the Netherlands, 34%; Denmark, 44%; France, 35%; Ireland, 58%; Italy, 22%; Sweden, 51%; and Switzerland, 27%.

In the United States, premium sales accounted for 31% of gasoline sales last year.

BRIEFS . . .

Russia has signed an agreement with Poland providing for increased deliveries of Soviet natural gas. A new pipeline will be built from gas fields in the western Ukraine to the Polish border to carry out the program.

A 2,000-bbl. Edeleanu dewaxing unit will be installed at the 5,600-bbl. refinery of Oelwerke Julius Schindler, G.m.b.h., at Neuhof, near Hamburg, Germany. The unit, which is part of a $7,560,000 modernization program, will be used in the production of high-viscosity lubricating oils. It will open in the first half of 1961. Oelwerke Schindler is a British Petroleum associate. The refinery's main activity is the production of lubricating oils and specialties.

A combustion research laboratory has been opened at British Petroleum's refinery at Kent, England. The facilities will enable full-fledged studies of corrosion in boilers and the problems of air pollution from boiler stacks.

Double-jointing of pipe has started in a storage yard at Marsa el Brega, Libya, for pipe to be used in a 100-mile 30-in. system from Esso's Zelten oil field to the Mediterranean Coast. Arabian Bechtel Corp. has the construction contract on the project.

An Italian firm is suing Shin Nippon Chisso for allegedly trying to manufacture polypropylene in disregard of the plaintiff's basic Japanese rights. Montecatini Soc. Generale per l'Industria Mineraria e Chimica Anonima of Milan sponsored research activities that led to the discovery of polypropylene plastics about 6 years ago. Montecatini charges Shin Nippon Chisso has embarked on a course that would result in patent infringements without even attempting to obtain a license.

The first unit of Russia's Novo Ryazan refinery, described as one of the largest in the country, has gone on stream southeast of Moscow. A new large diameter pipeline supplying crude to the plant directly from Second Baku fields near Aletyveevsk, Tataria, is scheduled for completion in 1961.

An Iranian products line from Shahrud to Meshed will be built by Williams Brothers. The 280-mile 8-in. line will be an extension of the 240-mile line from Rey to Shahrud now being built by Williams.

First Red Chinese rig in the 10,500-ft. class has gone into service in Yumen field, Kansu Province. The outfit was built at a Lanchow factory with the help of Russian technicians.

COUNTRY-WIDE TESTS PROVE HOW TOTCO CONTINUOUS END-POINT ANALYZER CUTS CONTROL COSTS ...INCREASES YIELD

In major refineries from the East Coast to the West, the new Totco continuous End-Point Analyzer has demonstrated its ability to provide better control over product quality and yield. It quickly pays for itself and steps up profits. ■ This sensitive instrument continuously indicates the Engler End Point of a hydrocarbon stock or commodity in an operating range of 200° F. to 700° F. It delivers reproducibility within ±1°F., with results that correlate with ASTM D86 or ASTM D158. And its continuous analysis cuts the usual delays between quality change and compensating plant control... eliminates the time lag of batch analyzers or conventional laboratory tests. ■ Write or call today for further information. Request Bulletin 5900-11.

CASE HISTORY #1

Major Eastern Refinery

Use of the TOTCO End-Point Analyzer enabled this refiner to step up end-point specifications of reformer feed stock by 10°F with safety. Result: increased yield and a saving of over $200 a day. On the basis of this test, six additional Totco units were ordered!

CASE HISTORY #2

Major West Coast Refinery

Both TOTCO's End-Point Analyzer and Initial Boiling Point Analyzer were used here on a narrow-cut solvent. It was found that the analyzers kept yield on grade better than 99% of the time! Previous average with laboratory control was 90%.

CASE HISTORY #3

Major Mid-West Refinery

In this test, the TOTCO End-Point Analyzer was mounted in a trailer and used on a crude still to control first-cut products on stream. So successful was the test that the company ordered two additional Analyzers for use at other refineries.

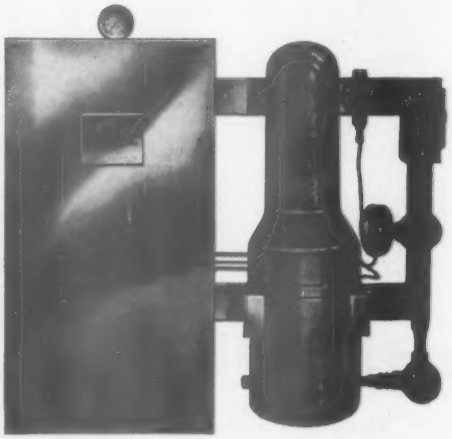
CASE HISTORY #4

Major Western Refinery

Demonstrating the versatility of the TOTCO End-Point Analyzer was this test where it was used to control the cut on heavy naptha. The test was a money-saving success, and the firm has since ordered additional units.

TOTCO CONTINUOUS INITIAL BOILING POINT ANALYZER

Totco also manufactures an Initial Boiling Point Analyzer. Write for Bulletin 1259-11 giving details and operating data.



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A SPECIAL SECTION

BY H. C. BOZEMAN
Gulf Coast Refining Editor

REFINERY MAINTENANCE ..Comes of Age

Enlightened managements are moving toward more centralized planning and scheduling, and decentralizing of responsibility of field control

REFINERS are calling for more efficient maintenance than ever, and getting it too. Maintenance organization and techniques are advancing at a fast pace to meet the challenge of lower margins.

Increased efficiency is coming in many areas of maintenance. Here are some of the phases receiving particular emphasis:

- **Organization.** Refiners are developing organizations that better cope with planning and scheduling.
- **Training.** Well-trained maintenance men are not born; they are made by much training and practice.
- **Onstream inspection.** This is a real breakthrough for maintenance. Now, the inside condition of the equipment and process variables can be gaged routinely.
- **Safety, plant upkeep, and emergency planning.** These programs can be made effective if they are actively pursued. None does well without strong assistance from the others.

Organization. Maintenance is moving towards more centralized planning and scheduling, but at the same time there is more decentralizing of responsibility of field control.

The trend may be compared to planning and scheduling refinery runs. Crude and product quantities are coordinated at a high level in the company. It is a matter of policy to determine the runs for each product at each plant. Production of the products then is the responsibility of each refinery.

Maintenance planning and scheduling have also moved to a high level. They are coordinated from the same level as the operating departments, so that management can consider the priority of maintenance work with regard to product requirements and give a check and balance to the operating departments.

Field control of maintenance goes to the foreman in the area or zone.

Craft supervision of maintenance men from the central shops to work assignments throughout the plant is giving way to zone and area systems. Using this system, foremen and maintenance men are assigned directly to plant areas.

The zone or area system puts maintenance work on a more informal basis at the work level. It greatly increases personal contact among plant personnel because of the smaller groups and the closeness of the maintenance men and the foremen to the job.

Refiners are including methods to keep the system flexible. They are avoiding the tendency of this system to build little empires throughout the plant.

Training. Yesterday's training isn't adequate for men who must maintain today's advanced equipment. The new equipment has not changed the basic functions of the crafts, nor does it appear that craft functions will change, but the need is apparent to refiners for broader and more comprehensive knowledge by maintenance men.

The new equipment requires that maintenance men have more basic knowledge to understand its functions and thereby understand how to make repairs.

Some of the areas where major equipment advances are occurring include electronic instruments, high-speed rotating equipment, and advanced metallurgy. Instrument men checked out on pneumatic instruments are now being turned into competent electronic craftsmen. But years of training are needed to prepare them for the new tasks.

Repair of high-speed rotating equipment requires new skills and knowledge. The balancing of high-speed rotating elements is more critical than for reciprocating machinery. Different equipment and more precision are required during repair. Clearances and alignments take on new meanings.

Advanced metallurgy promises to ease corrosion problems for extreme operating conditions. However, shaping and welding the new metals are difficult. Special atmospheres and close temperature control for preheating are only a few of the new techniques welders need to learn.

Onstream inspection. The tools are available for these techniques. It remains for the refiner to learn how to use them for the best results. Most of the available equipment and techniques complement each other, although there is some duplication.

Ultrasonic and X-ray equipment both measure wall thickness but for different purposes. Ultrasonic equipment is faster and less expensive. It locates areas requiring more detailed investigation. X-ray equipment is then used to make detailed study of these locations.

Corrosion probes flag refiners' attention to changes in corrosion. Refiners use them to monitor the corrosion

FIRE CREWS should be familiar with the technique of fire fighting using dry-chemical fire extinguishers. Training should be divided between classroom instruction and field training.

effect of changes in operating conditions and feed stocks. These probes have a fast response and quickly give a general picture of corrosion.

Onstream inspection offers refiners a means to plan turnarounds more thoroughly, to monitor corrosion, and to save time and costs by inspecting equipment adequately without opening it for visual inspection.

Safety, Plant Upkeep, and Emergency Planning

These programs are closely related, and each aids the effectiveness of the other. Plant upkeep and emergency planning include many items not directly related to safety, but which in the broadest sense of the word, are a part of safety.

Safety. Refiners are giving safety more serious thought. They find that a dynamic safety program pays dividends in increased plant efficiency, reduced down time, and higher morale. Safety is kept constantly in the spotlight. They change the safety program when an approach begins to lose luster. Otherwise, the refinery personnel soon sink back into old, unsafe habits.

Safety instruction is a vital part of any safety program. When each man is taught the safe way to do his job, safety becomes a matter of habit. Here are some specific suggestions for a successful program:

Enforce plant safety regulations about wearing safety equipment. Encourage wearing safety equipment by recognition of the individuals who save themselves from serious injury because of wearing it.

Set continuous safety goals. This avoids a letdown whenever a specific safety goal is achieved. A continuous goal: will our refinery operate today without even a single visitor to the first aid room? Thus, each day is a new challenge regardless of how many safe man-hours the record shows.

Stress the importance of reporting every accident no matter how minor.

Use the accident records to find safer methods. Teach personnel these new methods and improve safety.

Use first-aid training to teach men what to do in case of any plant emergency. First, train some personnel as first-aid instructors. Then schedule them to teach first aid to other plant employes. Conduct refresher and retraining programs in first aid at regular intervals.

Inspect safety and emergency equipment on a regular basis. Weigh the portable fire extinguishers. Dump and refill the dry-chemical fire extinguishers.

Operate emergency pumps and other emergency apparatus on standby.

Evaluate new safety equipment for possible use in the refinery.

Conduct safety inspections of all refinery areas both on a routine and random basis. List all safety hazards and discuss each item with responsible personnel. Follow up the work to correct the hazards.

Increase the interest of plant personnel by selecting them to make safety inspections.

Conduct gas tests before issuing welding and entering permits. If possible, issue permits for only one shift at a time.

Schedule safety meetings that are interesting and that discuss a current safety topic. Open the meetings to questions and discussion.

Stimulate interest in safety with contests and prizes for the best entry.

Plant cleanup. Experience shows that accident rates are lower when the plant is clean. This is a continuous program, and refiners are making it a matter of top policy to keep a clean refinery. Periodic cleanup drives are not effective.

Good housekeeping is the focal point of all programs directed towards general plant appearance. These include safety, painting, and emergency planning. A clean plant contributes to better safety, higher morale, and improved efficiency. Everyone is a part of the cleanup team.

Here are several ways to aid clean up: Put the scrap in containers located at strategic places. Stack materials and equipment for more efficient use and availability during maintenance. Wash off oil and grease from around machinery and process equipment.

Pick it up, stack it up, and wash it up.

Painting. Corrosion protection is the

primary reason for painting. It has, however, other less tangible but real benefits. A well-painted refinery enjoys better morale, advertising, and community relations.

Pastel colors have added much life and warmth to once dreary black-and-aluminum refinery units. Pastel colors shouldn't be confused with color coding. With pastel colors, two identical units may be painted differently. Refinery crews may be allowed to choose the colors for their units to build morale.

Paints for special places and purposes are available. Heat-sensitive paints are used on internally insulated equipment to show breaks in insulation and prevent hot spots on the metal shells from resulting in serious damage.

Silicone paints are useful for protecting hot surfaces such as furnace stacks and compressor discharge piping. Zinc-silicate coatings are useful in damp locations such as near cooling towers.

Attention to paint application pays dividends, and surface preparation is one key to more durable paint coatings. Sandblasting to bare metal surfaces provides the good, dry surfaces needed for holding primers. Painting over scale, rust, and moisture may result in early paint failure.

Sandblasting and painting after installation and while the plant is operating interferes with operation and prevents good paint application throughout the plant.

Refiners find that better painting results from complete painting before installation. Paint the new and replacement pipe and equipment in the paint shop or yard where it can be painted more easily. Then, only touchup painting is required after installation.

Refiners watch painting costs closely. They are delaying repainting until the paint begins to fail. Painting just for appearance sake to cover dirty paint is a costly practice.

Pastel paints cost more than do conventional colors, but the advantages outweigh the added costs. Cost is increased because of the great variety of color, the need for more stock colors, and more brush painting in the refinery units. However, the cost of painting tanks pastel shades is not much different from painting with conventional colors.

Emergency Planning

An emergency may involve only a small part of the plant, the entire plant, or a nearby plant. Thus, emergency plans must anticipate a whole range of situations. The purpose of these plans is to rescue and care for the injured, and to minimize property damage.

PROPER BANDAGING of cuts, sprains, and broken bones is one phase of first-aid training.

Emergency planning may be divided into phases for better coordination and control. Typical phases are fire fighting, refinery and unit shutdowns, evacuation of personnel, weather-caused emergency, employe and community relations, and communications.

Firefighting. Fire-fighting crews should be trained for all plant areas, with personnel assigned to man fire equipment in case of fire. Fire crews should be familiar with all the refinery's fire-fighting equipment, such as water, dry chemicals, foam, and fog, and should know the location of equipment throughout the plant.

A refinery area away from the process units should be selected for practice with the fire-fighting equipment.

Fire drills are an important part of training. Announced and unannounced drills are both helpful for training personnel and finding better methods. Here are points for better drills: Make the drills as realistic as possible. Lay fire hoses, open fire hydrants, evacuate personnel, set up the communications network, and simulate unit shutdown. Take movies and tape recordings of the drills and study for improvement in planning and methods for the next drill.

Refinery and unit shutdowns. The steps to shut down each refinery unit under emergency conditions should be planned, including the actions needed when failure occurs in electricity, steam, and other service, and in process streams. Locations of critical valves that isolate each unit from the rest of the refinery should be carefully spotted.

Operating personnel can practice shutdowns by tagging valves and switches. The plan should be reviewed for accuracy and to teach personnel improved methods.

Evacuation of personnel. Men should walk, not run to the nearest exit. Evacuation paths for all possible conditions of refinery emergency, location, and wind direction should be planned.

Evacuation drills should be conducted with fire drills, with the importance of orderly evacuation stressed. It is important to create an awareness that refinery personnel not expose themselves unnecessarily to the effects of fire and explosion.

Weather-caused emergency. All refineries are exposed to some form of weather-caused emergency, be it hurricane, tornado, flood, or blizzard. Some refineries also are in earthquake areas. Orderly shutdown and evacuation should be planned for each type of emergency. Loose equipment should be removed or tied down, and should be drained and refilled as needed.

Employe and community relations. These can be improved by using these ideas: Contact immediately the families of injured employes to render every possible aid and comfort. Make every effort to assure speedy release of approved news stories to the press. Release the names of injured only after notifying the families concerned.

Communications. A control center for all emergencies should be chosen. A good location is the main-gate guard house. Communications will be controlled from this location, and alarm horns and sirens, radios, crash telephones, and other control devices should be stored there.

Specific pointers for the communications plan are:

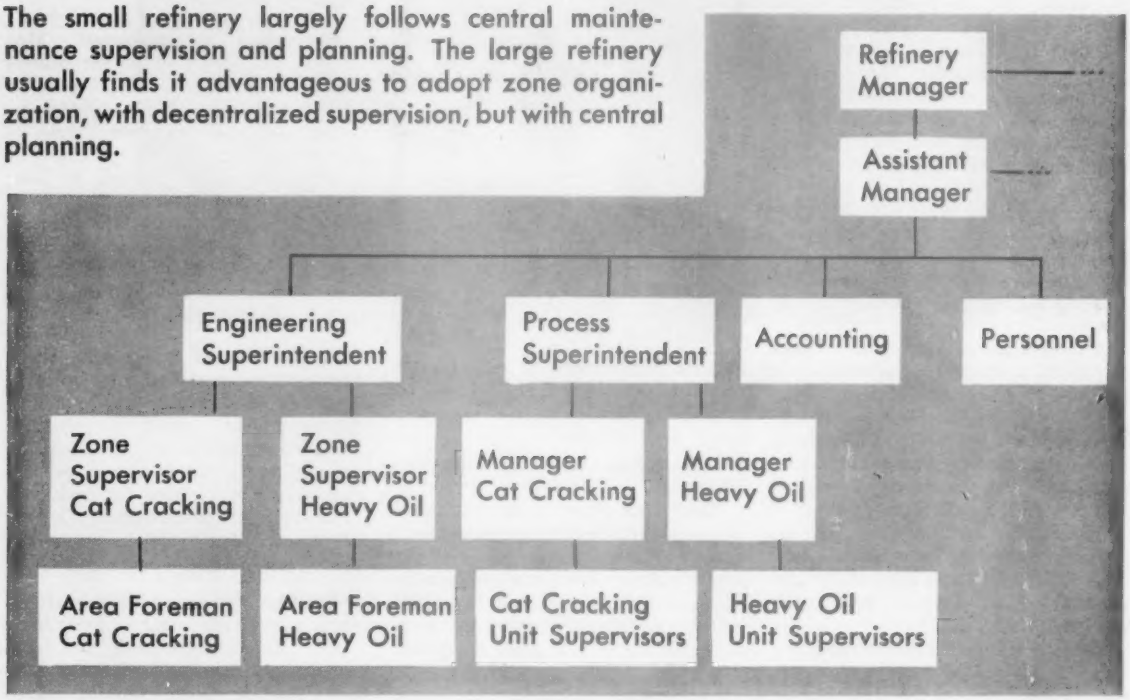
Establish radio and telephone communications with local disaster aid groups to request more emergency equipment or send the refinery's equipment to other locations away from the refinery.

Use portable radios to establish communications at the scene of the emergency with the control center.

Relay messages from the emergency scene over the crash-phone circuit to crash phones in offices and units throughout the plant.

REFINERY MAINTENANCE ..How to organize it

The small refinery largely follows central maintenance supervision and planning. The large refinery usually finds it advantageous to adopt zone organization, with decentralized supervision, but with central planning.



MAINTENANCE AND OPERATIONS are being handled on the same management level in refineries. Engineering superintendent takes care of maintenance, and his counterpart, the process superintendent, handles operations. Both report to assistant manager.

REFINERIES both large and small are making changes in maintenance organization and adopting new maintenance techniques to the same end—that of reducing costs.

Two broad organization trends are emerging, even though every refinery solves its problems individually.

One trend is more central supervision and planning. In general, the small refinery—less than 100,000-bbl.-daily capacity—is following this trend. The small refinery may be either an independent or part of a major.

The large refinery—over 100,000-bbl.-daily capacity—is following the other trend which is decentralized supervision and central planning.

These differences in maintenance organization between large and small refineries shows how one tool can be used in different ways for the same job.

Small-Refinery-Maintenance Organization

The small refinery has operated traditionally with as few people as possible, and since 1958 has found ways of operating with even fewer people. To keep its competitive position it has increased mantenance efficiency.

Labor forces have been reduced by early retirements and layoffs. Most common method of manpower reduction, however, is to stop new hiring and let normal turnover and retirements bring about needed reductions.

Organization is one way to improve maintenance efficiency. Also, much of the enthusiasm and vigor of making a more efficient maintenance organization spills over into other areas of maintenance.

Maintenance status. Maintenance departments in small refineries are on the same level as operations. The physical size of the refinery and the distribution of the units over the plant site determine to a large extent the type of maintenance organization best suited for the refinery.

The units of a small refinery are smaller and fewer in number, so they cover a smaller area than a large refinery. The shops and warehouse are about the same distance from all the refining units.

Maintenance meetings. Operations and maintenance schedule a daily conference to discuss new work orders and status of current maintenance, and to plan the next day's work. Maintenance makes the final selection depending upon priorities, materials, and manpower available.

Planning and scheduling. To in-

MAINTENANCE work orders are written by "equipment owners," or operating personnel in the large refinery. Maintenance then uses the work order to plan the job.

crease maintenance efficiency the small refinery is directing much more effort to planning and scheduling. The object is to know what manpower and materials are needed before starting the job and to have them at the job site when the job starts. But it takes a lot of work to do it.

Every effort is made to have the material at the job site when work starts. It saves time for the craftsmen and overcomes delay waiting for critical materials. More materials-handling equipment helps.

The small refinery uses written work orders by operations to request maintenance work. In many small refineries the plant manager reviews and approves them.

Tools. The small refinery is investing more money in tools to improve efficiency and reduce costs. Materials-handling equipment, shop equipment, and portable field tools are receiving the greatest emphasis. However, there is little investment in large, occasionally used tools. Large machining jobs are contracted to shops with the large machine tools. Rent tools, trucks, and cranes are used, also.

Turnarounds are a major undertaking for a small refinery. Linear programs for scheduling crude and product runs give the small refinery a tool to plan the best time and duration for turnarounds. Keeping them of short duration requires the use of most of the maintenance forces if only permanent personnel are used. Work in other refinery areas slides during these times.

The small refinery is using two basic ways to increase the utility of its maintenance personnel. Turnaround work is contracted or temporary employes are hired for the turnaround.

Contracts. The contractor takes over the complete turnaround job. Planning is coordinated with the refinery staff and is based on experience and onstream inspection. The contractor orders the materials, staffs the maintenance crews, and supervises the work. The refinery makes the unit available to the contractor and inspects the repairs. Many variations are possible for contracting turnarounds.

The small refinery contracts more special jobs and maintenance jobs away from the refining units. Rehibilitation of plant roads, painting of tanks and pipeways in the tank farms, and earthwork for underground piping are several items contracted frequently.

Temporary hiring is also a way to increase the effectiveness of permanent employes. Example: A small refinery plans a turnaround that needs more men than available from the permanent forces. The permanent forces are augmented by temporary personnel during the turnaround.

During the turnaround some of the permanent employes are promoted temporarily to foremen and pushers. Everyone benefits from this arrangement. The permanent personnel take greater pride in the work with greater responsibility and do a better job—and they know that if the job is not done right they will have to make repairs themselves after the turnaround.

Small size favors centralized craft supervision. The small refinery depends upon craft foremen, although there is a trend to multicraft supervision. All the foremen report directly to a centralized organization.

Large-Refinery-Maintenance Organization

The large refinery since 1958 has changed from a ponderous machine moving slowly with no sense of direction to a sleek, flexible machine driving relentlessly for greater efficiency. The 1958 recession awakened the large refinery to the realities of economics, and early retirements and layoffs quickly reduced the numbers of employes.

These steps helped, but much work remained to be done.

Organization. The large refineries found their maintenance systems had become inflexible. Revamped maintenance organization is one way to add flexibility and improve efficiency. Here is a new, flexible system typical of those large refineries have developed. The new system incorporates the advantages of the old system and eliminates the disadvantages.

- **Maintenance is ranked** on the same level as the operating departments.
- **The refinery is divided** into zones

according to operating departments, as much as possible. The zones are further divided into areas by refinery units.

• **A foreman** is assigned to each area. He is a multicraft foreman who supervises all crafts assigned to his area. A zone supervisor coordinates the area foremen in the zone.

Maintenance status. Maintenance is ranked on the same level as the operating departments. Put on this level, it gives check and balance to refinery organization and they become oriented to costs rather than production.

Now, both maintenance and operations have the responsibility of making the products at least cost.

Budgets. Large refineries budget maintenance costs. Operating departments propose the budgets for the following year. Maintenance reviews the budgets before submission to management. During review, maintenance cuts the maintenance portion of the proposals by the amount of increased productivity of the maintenance department.

After approval, maintenance keeps check on the money expended and informs operations. Budgets are prepared 3 to 6 months before the start of the next fiscal year. Proposals are based on history of the units, deferred and nondeferred maintenance, turnarounds, and product requirements.

In some large refineries the maintenance departments estimate the cost of maintenance work orders before final planning and scheduling. When the cost appears high, the operating department is requested to reconsider the work order.

Work orders. The large refinery uses written work orders to request maintenance. Procedures in most large refineries are for only the equipment owner to write maintenance work orders. Operating departments are made "owners" of refinery units, for example. Also, the owners have the duty of preparing budgets for their equipment.

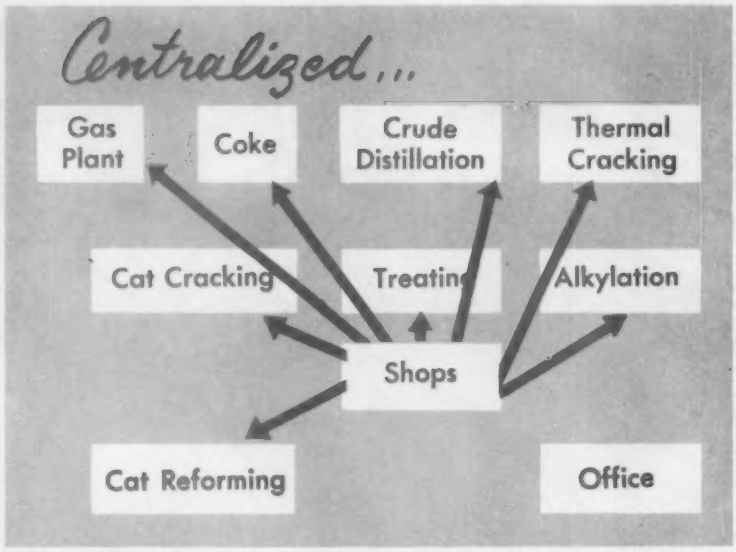
After the work order is written and approved it is submitted to maintenance for execution.

Maintenance work orders are a basic document in large refineries. The operating departments initiate the work order by describing the work, the priority, and the accounting.

Maintenance then uses the work order to plan the job. Estimates of both labor and material are recorded in spaces on the front of the work order. When complete, sufficient copies are reproduced for distribution to the originator, zone supervisors, and area foremen.

The new work order is scheduled or put in the back log according to priority and material status.

There are some exceptions to "owners" only writing work orders. Turnarounds are an example. Turnaround planning and scheduling are done by a central group in maintenance which coordinates turnarounds plant wide. This group writes the turnaround work orders.



CENTRAL SHOP is nerve center for centralized maintenance setup.

Zone areas. The large refinery has divided the refinery into zones along operating department lines as closely as possible. A large refinery may have the heavy oil, catalytic cracking, reforming, and lube-oil departments, for example.

A zone supervisor is in charge of each zone and is on the same level as his comparable operating-department manager.

Each zone is divided into several areas and generally according to refinery units. The heavy-oil department may have units such as the pipe still, thermal cracker, and continuous sweetening and blending areas. An area foreman is in charge of each area and corresponds to the unit operating supervisor.

The area foreman is the only maintenance man assigned permanently to any area. He supervises all crafts assigned to his area. He reports time for the assigned craftsmen, both hours on each job and which jobs the craftsmen worked that day.

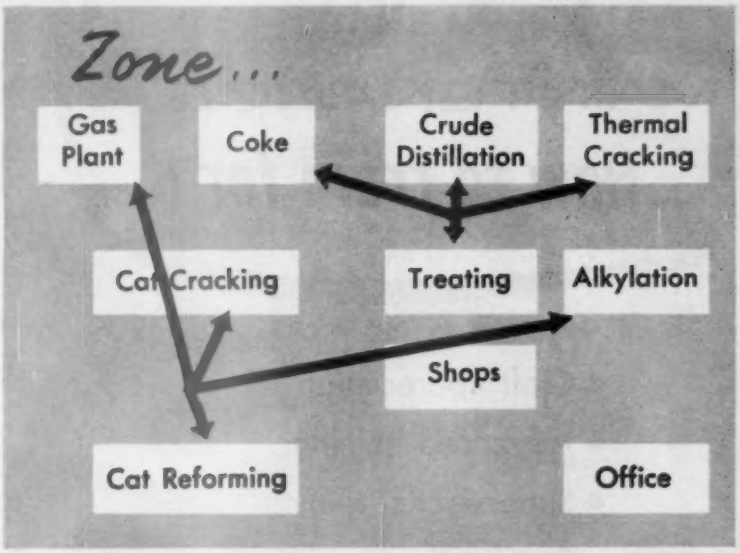
The craftsmen are not permanently assigned to any area or zone. They can be assigned to any place where needed. The only exception is permanent assignment in one of the craft shops.

How it works. A daily meeting is held between the zone supervisor and the operating department manager. The condition of the refinery units is discussed, new work orders are submitted, and the schedule for the next day is reviewed for status of work in progress, changes in priority, etc.

After these meetings the schedules are taken to the zone planning and scheduling office for final selection of the jobs based on zone-allocated manpower. Manpower is assigned by name or badge number for each approved job. The work list is posted on bulletin boards and sent to the zone supervisor and area foreman before the end of the day.

When a craftsman is moved from one area to another, his tools go with him. Since the work lists are posted before the end of the day, the craftsman knows the location of his work the next day. And his tool box is moved to the new area that night. The next morning the craftsman reports directly to the new job, and the area foreman goes over it with him.

As a practical matter, movement of craftsmen from one area to another is kept within reasonable limits. The central planning and scheduling group issues manpower allocations for each zone. The zones assign men to areas as the work load demands and shift them about the zone as needed. When zone allocations change, craftsmen are sent to or received from other zones.



ZONE MAINTENANCE provides for a number of maintenance centers throughout the refinery.

Turnaround planning. Turnarounds in large refineries are planned by the central planning and scheduling group. The zones are left free to concentrate upon the special requirements of daily maintenance.

Large refineries have a separate turnaround crew. These crews move from one turnaround to another to another. The manpower level in the turnaround crew is not static, but varies with the work load. The men assigned to turnaround crews are moved into or out of zone assignments as needed.

Turnarounds are planned in detail and, also, are a major undertaking for a large refinery. Because large refineries have so many units there is a turnaround in progress practically all the time. And they are planned to the last detail. Coordination is close with the operating departments. Inspection records and on-stream inspection determine how much repair work is needed.

Before the turnaround begins, spare parts from the warehouse are requisitioned and put in portable warehouses that are sent to the turnaround site, along with a portable office. In it are located telephone and radio communications. The turnaround supervisor and all his area foremen have office space in the trailer. A mobile tool room is moved to the turnaround site, also. Turnaround crews are scheduled for one or two shifts, and for all three shifts on critical jobs. The men are shift-changed to avoid overtime.

Turnarounds proceed smoothly by having at the site the office, communications center, portable warehouse, and mobile tool room. House trailers and semitrailers are popular for these uses.

Communications. Radio communications are practically universal in large refineries. All mobile equipment is dispatched by radio. With radio communications it is unnecessary for vehicles, cranes, fork lift trucks, etc. to return to the central shop at the end of each assignment. They can go directly to the next job.

Radios are going into the plant too. Foremen and craftsmen working away from telephones carry portable radio equipment. These are particularly useful for working in the tank farm and on top of tall units.

Radio paging systems are used. Systems can be separate from the telephone system or connected into the telephone. The man carries a receiver on his belt or shirt pocket that buzzes or vibrates when his code number rings. He then goes to the nearest telephone and dials his office who will relay the message, or he dials a code number and is connected directly with the waiting party.

"Turnarounds in large refineries are planned by the central planning and scheduling group. The zones are left free to concentrate upon the special requirements of daily maintenance."

Problems with the new system. The large refineries are optimistic about their new system. But moving tools from one area to another has its difficulties at times. When schedule changes are made after working hours, it may be difficult to find and move the tools that night. When schedule changes are made during the day, material-handling equipment is dispatched to pick up the tool boxes and relocate them in the new area.

The personnel in the areas do not really feel they have a "home", but the large refinery is facing this challenge. First, they are making photo books of all the maintenance personnel and send copies to area foremen and zone supervisors. The foremen can study the photos and are better able to call each man by name.

Second, refineries are stepping up training. Foremen who previously were trained only in one craft need to learn about other crafts. The craftsmen, who are more independent of their craft foremen, are given more training in the latest techniques of their craft. The craft foremen still retain administrative control over their craftsmen for vacations, qualification tests, etc.

Contract maintenance. The large refinery does not use contract maintenance to the extent of the small refinery. It does contract maintenance for jobs that are done infrequently and away from refinery units. Also, when special equipment is used, the large refinery contracts these services.

The large refinery may use contract maintenance for specific and well-defined jobs during turnarounds, such as replacing trays in distillation towers and making refractory repairs in heaters.

Contract maintenance of special equipment immediately after installation is common. An example is contract maintenance of air-conditioning equipment in the shops, control rooms, and office building. Some large refineries contract painting of entire refinery units after a turnaround is completed.

Few large refineries contract entire turnarounds.

Construction. Some large refineries contract the construction of new refining units. Others do most of their own construction.

The construction crew in a large refinery is much like the turnaround crew. It is assigned and scheduled by a central group. Portable offices, tool rooms, and warehouses are moved to the job site during the project.

REFINERY MAINTENANCE ..How to train for it

- Craft appreciation
- Advanced training
- Supervisor's training
- Special short courses
- Offduty training
- Apprentice training

TRAINING in the modern refinery is taking on new significance. New maintenance systems, new equipment, and new tools and techniques are changing training needs.

Gone are the times when only new employes were trained. Now everyone, regardless of length of service, is being trained.

Here are some of the forms of training that refineries are conducting.

Craft - appreciation training. The new multicraft foremen learn the functions of all crafts.

Advanced training. The craftsmen learn new skills to repair modern equipment and refresh themselves in their craft.

Supervisors training. Supervisors learn leadership and human engineering, and broaden their background in company philosophy, economics of oil refining, and marketing.

Special short courses. These teach a new technique or how to use a new piece of equipment.

Off-duty training. Men enroll in approved correspondence courses, trade school, or college courses to qualify for advanced training programs at the refinery.

Apprentice training. This is still important for the new employes, but now there are fewer new employes.

Refiners have discovered that training is a continuous job. Apprentice or striker training is only the beginning of a career in the refinery. In the past, apprentice training went most of the way to training a man for a career. This is no longer true. The rapid advances in equipment, materials, and techniques are increasing the depth of training needed by each craft.

New maintenance systems, new refining processes, and changing economic conditions are some of the outside forces affecting training. Except for apprentice training, refineries conduct all other training as advanced training.

To get the most from training, only qualified personnel should be enrolled in the training classes. Written tests should be provided during and at the end of the course. Successful completion of training should be linked with pay raises and promotions.

These increase the incentive to learn the subject matter. Without tests, trainees conclude that everyone passes and incentive to learn is lost.

Written tests given before enrolling trainees in new classes gives incentive to all. Qualified trainees can proceed with advanced training without repeating basic training. Unqualified trainees have the incentive of becoming qualified for advanced training.

It takes years to train qualified craftsmen in the modern refinery. Once started, conduct training sessions at regular intervals. Sessions 2 to 4 hours long are popular. The training period is broken into lecture, demonstration, and laboratory-practice periods. Informal discussion during the training sessions is encouraged.

Advanced training groups should be divided into small classes of 10 to 20 trainees. It gives a chance for better instructor-trainee contact and does not take an excessive number of one craft from maintenance work at one time.

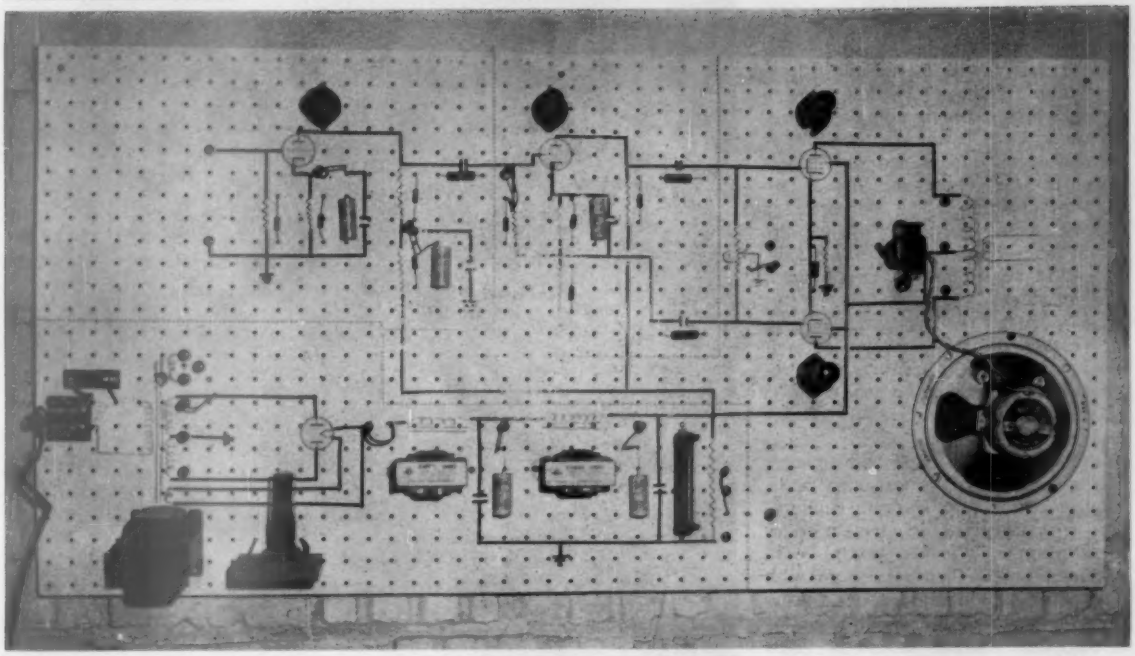
Craft-appreciation training. The purpose is to teach new area foremen some of the functions and duties of crafts other than their own. The promotion ladder to foreman in the old maintenance system was via craft foreman. Therefore, opportunities for advancement were limited.

The new maintenance system has changed all that. The door is open for more craftsmen to become foremen via area foreman. While the door is open wider, there also are greater demands made of the foremen. Multicraft supervision and more responsibility for planning and scheduling maintenance work in his area are some of the increased demands.

The new area foreman can supervise more effectively when he understands the other crafts in addition to his own. The program is directed mainly to craftsmen recently promoted to foremen. Its purpose is to teach new foremen the functions and duties of each craft, but not make them skilled in the craft. Another objective is to inspire new foremen and make them want to grasp for new ideas and knowledge. Talking somewhat above the heads of the new foremen now and then is one way of fulfilling the second objective.

The program presents a comprehensive view of each craft to the new foremen by beginning with a history of the craft; advancing to the equipment the craft services, the tools they use, and how the craft does its work; and by showing how to coordinate the craft with others.

The training program can be scheduled in many ways. It has maximum benefit when it is presented to all



SCHEMATIC LAYOUTS, such as this one of an audio amplifier with full-wave rectifier power supply, are helpful in training.

foremen in the shortest practical time. The program is divided into two or more phases. Foremen are divided into groups, and groups are scheduled consecutively until the phase is presented to all foremen.

Craft appreciation is one program that the foremen put into immediate use. In the area system they contact all crafts, and the knowledge they learn in the program is used immediately.

Advanced training. This updates craftsmen in their craft and makes them better equipped to maintain the new and existing equipment in refineries. Also, it refreshes them in their craft, builds morale, and motivates them to do a better job. Many of the old timers are eager to learn the new tricks of their trade.

Here are pointers for advanced training:

Select trainees for advanced training by competitive tests. Test the applicants in mathematics and basic science in addition to their own craft. Base the level of advanced training programs on the test results. Provide a means for unsuccessful applicants to qualify themselves for advanced training.

Give trainees written tests throughout the training program to test their grasp of new knowledge and to improve teaching techniques.

Tie pay raises and promotions to successful completion of advanced training. Conduct advanced training classes during normal working hours. Cover the weakest areas with advanced training first. These are the zones with the most payout.

Divide the trainees into classes of 10 to 20 men. Small groups get the maximum benefit from instruction. There is more group participation, discussion, and questions about actual field problems.

Schedule each class for a training session once a week until the course is completed.

Some of the crafts are receiving particular emphasis in refineries just now.

Pipe-fitting topic summary time

PIPE FITTING

Topic—	Summary	Allotted time (minutes)
Introduction	History of pipe. Where and how pipe fitting started. How developed to present form. Job classification.	30
Pipe	Material, process of manufacture, types of joints and standards and specifications.	40
Fittings, flanges, bolts, and gaskets	Selection, dimensions, ratings, types, how to order—common to refinery practice.	60
Valves and cocks	Functions, ratings, selection, and general maintenance.	60
Specific jobs	Direct application of pipefitter skill as used in refinery pipe fitting.	110
Coordination	Coordinating activities of pipefitters with other crafts.	30

Pipe fitting total, 5 hours, 30 minutes

Instrument men. Instrumentation is advancing more rapidly than any other segment in the refinery. Electronic instruments are replacing pneumatic instruments, computer control is here, and nuclear instruments are finding their places in refinery units.

These are but a few active areas in this rapidly changing field. Pneumatic instrument men must be trained in electronics to service electronic instruments. Training courses begin with basic mathematics, and proceed into algebra, trigonometry, geometry, physics, electricity, and finally into electronics.[1]

Machinists. The day of the recip-

rocating machine has passed even though many will be around for a long time. High-speed steam and gas turbines are becoming common in refineries. Now, practically every centrifugal pump is equipped with a mechanical seal. These are just a few of the advances. The concepts of clearances and alignment are all different from the old practices. Machinists must be trained to repair these new machines.

Welding. Alloy and specialized metals are being used frequently in refinery processing equipment. These materials do not weld as easily as low-carbon steel.

Preheating and inert atmospheres are two of the important new techniques welders are learning. Laboratory-type instruction is good for welding training. Trainees should weld specimens, and then test them with destructive and nondestructive testing machines. When the training course is complete, trainees should be given ASME or other qualifying welding tests.

These are but three of the crafts. Each of the others is advancing at a rapid pace. Pipefitters are using plastic pipe, brickmasons are using quick-setting mortars, and painters are using more-difficult-to-apply paints and mastics.

The speed of product development in all areas will soon make necessary more advanced training.

Supervisor training. Many subjects are part of any supervisors' training program. The purpose is to make more effective supervisors for the company.

Leadership is one of its most important phases. The attitudes, authority, and responsibility of effective leadership are studied in detail. Subject matter is presented in as many ways as possible in lectures, discussion groups, question-and-answer sessions, visual aids, and case studies.

Supervisors want to know how they fit into the over-all scheme of the company and where they stand. Many of the new supervisors are former craftsmen and promotion to foreman changed completely their work habits.

The company's competitive position, economics of refining and marketing petroleum and chemical products, organization of the company and refinery help the supervisor become company-orientated. Also, marketing-practice and customer-relations studies give added depth of understanding to supervisors.

The union contract is studied and interpreted. Supervisors and foremen are told where they stand and management's position on the contract.

PRACTICE EQUIPMENT shows voltage drops and current flows in a.c. circuits.

Short courses. These training periods satisfy specific needs for different groups. A course of wide interest would be description of the new maintenance system. Everyone in the maintenance department should attend a lecture about it.

The history of the labor movement is of great interest to new foremen in helping them understand the content of the union contract and how to execute it better. They read and study the labor movement from original documents of the early leaders. They study also supervisor-worker relationships.

Specialized instruction should be reserved for specialists. For example, instruction about a new exchanger-tube rolling procedure would be of primary interest only to boilermakers.

Many courses of short duration are needed to keep personnel abreast of a current topic. Written tests are important for these courses also. Refiners insist that personnel firmly grasp the new subject matter.

Off-duty training is primarily to assist unqualified applicants to become qualified for advanced or apprentice training. It motivates them to want to learn and advance their knowledge. These men can enroll in approved correspondence courses, educational TV courses, or night school at trade school or college level. Upon satisfactory completion of a course the employe is reimbursed for expenses. Some companies reimburse all expenses of books and tuition up to a set amount, while others reimburse only part of the expenses.

After successful completion of a course, the company retests the employe to its satisfaction before enrolling him in an advanced or apprentice training course.

Off-duty training is not limited to unqualified applicants. Many companies encourage their personnel to take off-duty training at local trade school and colleges, with reimbursements for all or part of the expenses. It motivates them to want to learn to keep increasing their knowledge.

Apprentice training. Standardized apprentice-training programs are available for use by refineries. The apprentices are selected by written tests. Apprentice training requires off-duty study as well as on-the-job instruction and training by qualified journeymen craftsmen. An apprentice must complete satisfactorily each phase of training before proceeding to the next.

New personnel are eligible for apprentice training, but the emphasis is less because there haven't been many new personnel hired in the past few years.

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REFINERY MAINTENANCE ..How to do it

Onstream inspection: ultrasonic, radiographic, temperature-indicating panels

Onstream maintenance: exchanger cleaning, built-in and portable, spares

Offstream maintenance: chemical cleaning, better materials, patch kits, photographs, machine methods

THE SCOPE of maintenance activities has broadened considerably in recent years. Repairs and maintenance can now be done while refinery units are operating. Some examples are hot-shot chemical cleaning and valving-in portable equipment while the rest of the unit remains onstream.

Also, inspection does not need to wait until the unit is down and dismantled. Onstream inspection saves time and money because it finds areas needing repair without the expense of a visual inspection.

Maintenance is using advanced technology for onstream inspection, chemical cleaning, corrosion inhibitors, onstream maintenance, and machine methods for planning turnarounds.

Onstream Inspection

Onstream inspection is any method of measuring the internal condition of equipment without actually seeing it. Thus, measuring wall thickness is only one part of onstream inspection. Onstream inspections also find the degree of fouling, the condition of internal insulation and other internal parts, and effects of inhibitors and operating-condition changes on corrosion.

Ultrasonics, radiography, corrosion probes, and temperature indicating paints are several onstream inspection tools.

Ultrasonics. Wall-thickness measurement by ultrasonic devices is widely used in refineries. When the equipment is used by trained people it is a practical way to obtain a large number of accurate thickness measurements at reasonable cost. Thickness measurements can be made while the refinery unit is operating and at temperatures up to 400° F., provided the sounding head can contact one side of the metal surface.

Ultrasonic thickness surveys made on a regular interval record the corrosion history of the equipment. Location of each test is clearly marked with a number and decal so measurements can be made over and over again at exactly the same spot.

Some refineries contract their ultrasonic inspection surveys and others buy their own equipment to make the inspections themselves. If inspection is needed on a large number of points at regular annual or semiannual intervals the service contractor is usually less expensive.

Initial setup of a refinery unit for routine ultrasonic surveys may take 1 day to 1 week, depending on the number of points. After the first survey, subsequent surveys can be done much more quickly. Experienced operators can take measurements at 300 to 600 locations a day.

The cost of contract inspection can be either flat fee or day rate depending upon the company and the job scope. With contract inspection the refinery removes the insulation and erects the scaffolds.

Data sheets are preferred for recording readings rather than isometric drawings. The data sheets can show the original thickness, previous readings, and other data the isometrics cannot.

The Audigage and Vidigage are two ultrasonic thickness-measuring devices that use resonate frequency to measure thickness.[1] Pulse-echo devices have not been as accurate as resonate-frequency devices, however, the Ultragage claims accuracies of plus or minus 0.01 in. under normal conditions.

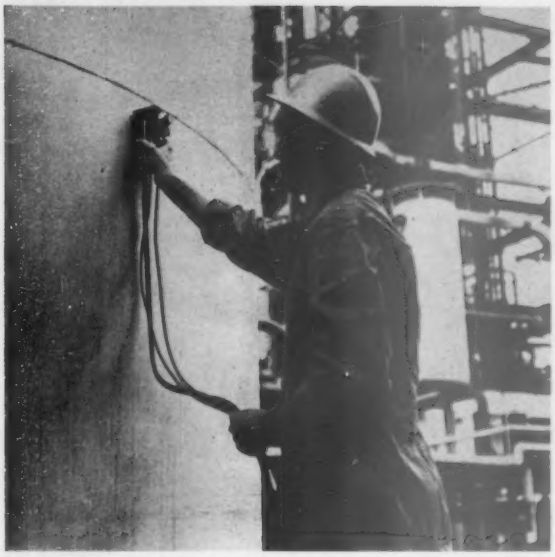
Pulse-echo devices are used extensively for flaw detection, and are very good for this use. The Reflectoscope is another pulse-echo device.

The Audigage is a portable battery-powered instrument weighing about 15 lb. The operator carries the instrument and the signal is received through earphones. A trained operator can estimate the amount of pitting and extent of fouling from corrosion, scale, and deposits by the quality of the audible signal.

The Vidigage is not carried by the operator and uses cables up to 150 ft. long between the instrument and sounding heads. The signal is presented on an oscilloscope and the Vidigage needs a source of 110-volt a.c. power. A two-man crew operates the Vidigage and Ultragage. One takes readings at the instrument and the other spots the sounding head on test locations throughout the unit. They communicate with a sound-powered telephone.

More measurements per day can be made with the Vidigage and Ultragage than with the Audigage.

Radiography complements ultrasonic thickness measurements. It also measures wall thickness and in addi-



ULTRAGAGE INSPECTION gives indications of minute cracks, inclusions, undercutting, and other welding flaws. Photo courtesy of International Inspection, Inc.

AUDIGAGE measures thicknesses of metals at permanent test locations. Photo courtesy of Engineering Test Services, Inc.

tion does several things ultrasonics cannot. Radiography can measure wall thickness of insulated equipment without removing insulation. It can inspect the condition of internal parts not accessible by other onstream inspection methods. An example is inspection of the inside pipe of a double-pipe heat exchanger.

Radiography can frequently find why equipment is not operating properly. An example is locating a loose bubble cap blocking a drawoff nozzle.

It is gaining acceptance in refineries for making onstream surveys of wall thickness. Large areas can be covered in one exposure. The film, sensitive to gamma-ray radiation, is placed on the opposite side of the equipment from the source.

The actual thickness can be calculated from the thickness shown on the film using the relationship between similar triangles. Iridium 192 and cobalt 60 are two commonly used radioisotopes.[2,3]

Radiography and ultrasonics show whether the equipment is safe to operate, is unsafe to operate, or is approaching an unsafe condition.

Radiography is more expensive than ultrasonic thickness surveys. The costs vary, of course, depending on the time and difficulty in obtaining the measurements.

A general rule of thumb for contract costs of ultrasonics is $1 per reading, and radiography, $4 per square foot.

Radiography is slower than ultrasonics. Exposure times of 1 hour are not uncommon. Safety precautions are different. It is advisable to rope off the unit when radiography is in progress. Special shielding may be necessary in some places to prevent radiation exposure to operators on the unit while it is onstream. Other maintenance on the unit should be stopped while radiography is in progress. Ultrasonic measurements do not interfere with operations or maintenance activities.

Onstream measurement of wall thickness by either ultrasonics or radiography can reduce down time and prolong runs. Replacement parts can be made and installed before corroded parts fail and result in unscheduled shutdowns.

Corrosion Probes

Corrosion probes can flag refiner's attention to corrosion before it does major damage. These electrical-resistance probes are widely used in refineries and API reports that over 1,500 are in use in the North American Continent.[4] Corrosion probes measure the corrosiveness of process and utility streams. Their fast response is helpful in quickly solving corrosion problems.

Corrosion probes are found on almost every type of refinery unit. Crude-distillation units have the greatest number of corrosion probes and are followed by vapor-recovery units, water systems, and catalytic reformers.

Probe location is critical and representative temperature and velocities are the most important needs. For the most use, the data from corrosion probes should either reproduce reasonably well the corrosion rates or follow the trend in corrositivity.

Corrosion probes are located in that part of the stream where corrosion is worst, turbulent flow conditions exist, and temperature is highest. Corrosion probes are properly placed in the condensed phase of crude-unit overhead condensers. Corrosion probes in the inlet and outlet of heat exchangers can sometimes be interpolated to reproduce the corrosion rate of the tubes.

Corrosion probes are usually located in the process stream, and when corrosion is sensitive to velocity, the probes may corrode faster than the walls. Some streams corrode by pitting and when an active pit develops, the probe shows a sudden increase in corrosion rate. If the probe surface was passive when installed, the corrosion rate will be low until the film is broken and active corrosion starts. Protective films may form on corrosion probes and show abnormally low corrosion rates, also.

Nonretractable and retractable corrosion probes are available. Corrosion probes have been used at pressures as high as 1,900 psig. and temperatures as high as 1,000° F.

Temperature-indicating paints give a dramatic view of the conditions of internal insulation. Whenever the internal insulation cracks or wears thin and the shell becomes hot these paints irreversibly change color.[5]

Early warning of hot spots on the steel shell can save crash shutdowns and production foulups. The paints are applied on the steel shells of internally insulated catalytic reforming reactors, catalytic cracking re-

actors and regenerators, and other internally insulated equipment. They show visually the location of a hot spot regardless of its location on the equipment and how inaccessible it is. No other inspection method has this advantage.

The temperature-indicating paints are made from modified silicone and acrylic resin combinations and cost no more than other modified silicone paints for hot surface applications. Installation cost is little more than any other good paint job.

Surface preparation by sandblasting is preferred and the paints may be sprayed. The early warning given by these paints is so effective that it is practical to use less-expensive carbon steel for hydrogen-handling equipment where alloy steel is common.

Analysis of process operating variables is a classical method of onstream inspection. A check on records of flow, pressure, temperature, and product quality give an indication of the fouling and internal condition.

Turnaround dates are based on a projection of the decline in operating performance. Similarly, cleaning efficiency is revealed by the unit's performance immediately after a turnaround.

Onstream Maintenance

The tempo of onstream maintenance has increased and contributes to longer runs which are necessary today.

Maintenance and repair while the unit stays in operation have several forms. Broken equipment is repaired while it continues in operation; and spare equipment is built in at critical points.

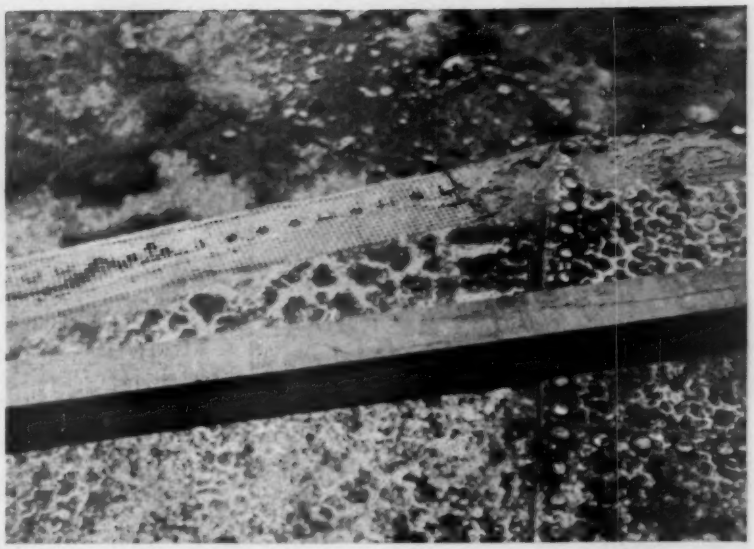
Onstream repair. Some equipment can be maintained while it continues operating. For example, here are two methods for cleaning the cooling-water side of heat exchangers when they become fouled with hard-water deposits and throughput is limited:

1. Chemically clean the unit. Move the chemical-cleaning tank to the unit and tie it into the cooling-water inlet and outlet. Coordinate the cleaning closely with the operating department. Block off the cooling water from the exchanger and begin circulation of the cleaning solution. Watch the exchanger temperature and tower pressure, and stop quickly when they reach preestablished limits.

It may take three or four switches before the water side is clean. This hot-shot chemical cleaning may be repeated at intervals until product-side fouling limits rates.

2. Scour with sand. Here the cooling-water inlet is left open, but the outlet is diverted to the sewer. Sandblasting sand is introduced into the cooling-water inlet which then scours out the scale and deposits.

Corrosion inhibitors also contribute to cleaning the process side of heat exchangers while they are in operation.[6]



TANK PATCHING with wire mesh and epoxy adhesive cuts replacement expense on tank roofs and bottoms. Mesh covers corroded portion, and adhesive (note partial covering at right) is applied over it with a trowel.

Spares. Built-in spares have kept many a refinery unit operating when equipment fails. However, refiners are sparing less equipment in new construction than previously. The refiner then operates the new unit, finds where there are trouble spots, and installs spares only in those locations. The practice saves capital costs and reduces spare parts, but requires good judgment to avoid crash shutdowns.

Portable spare equipment has a place in a refinery when several units use the same size equipment. Skid-mounted pumps and heat exchangers can be moved easily and valved into the unit while the permanent equipment is repaired. Also, hot taps are made while the unit is onstream to tie in spare equipment or plant expansions and revisions into the unit.

Mobile electrical transformers complete with switch gear are useful throughout a refinery.

Offstream Maintenance

Offstream maintenance has become more sophisticated. It is using more versatile tools and techniques to increase efficiency. Chemical cleaning, corrosion inhibitors, better materials of construction, and photography are used with increased frequency.

Chemical cleaning is used for process-side cleaning in addition to the older use of removing hard-water deposits from the cooling-water side of equipment. It is a versatile, cost-saving tool for refineries, and has a wide range of application. It is used for in-place cleaning of piping, heat exchangers, and towers, and for soak cleaning of heat-exchanger bundles and salvage parts.

Chemical cleaning cannot be applied universally to all conditions. It has two important limitations. Plugged tubes and pipe cannot be chemically cleaned, and there is no solvent known that will dissolve coke or carbon.

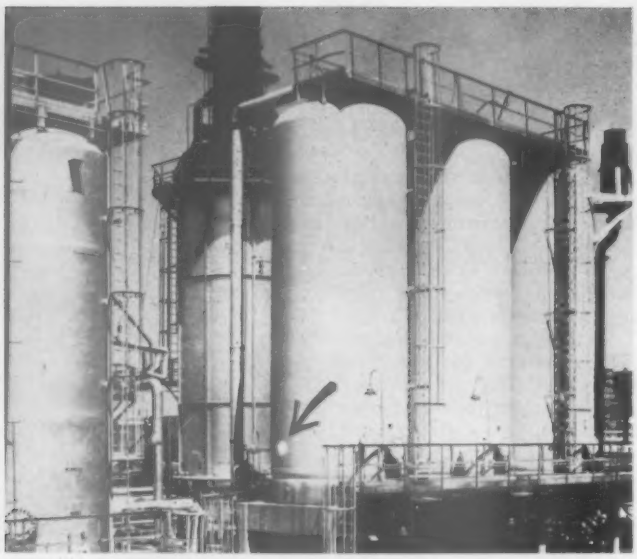
In-place chemical cleaning may be divided into two phases. The first phase is planning and the second is field control.

The planning phase is perhaps the most important because it is during this phase that it is determined if the proposed job can be done. Planning has steps of sampling, analysis, economics, and piping connections.

The sample should be representative of the scale or deposit. The sample should be obtained in chunks and down to the metal surface. The sample is analyzed physically and chemically. What does it look like? Is it soft, hard, layered, or friable? Is the sample inorganic such as hard-water scale, organic such as heavy oils and tars, or a mixture such as iron sulfide and tar?

The sample is tested in the proposed chemical-cleaning solution to check its efficiency. Possible corrosion of the equipment is checked at the same time efficiency tests are run and in the same solution.

STUDY OF EQUIPMENT FAILURES just as they happened provides useful maintenance information.



TEMPERATURE-INDICATING PAINT changes color when vessels or lines become overheated. Conditions can then be corrected before equipment fails in service.

Cost of chemical cleaning can be estimated based on the efficiency tests, and costs are then compared with mechanical methods. Cost of down time and the cost of reduced life from mechanical handling of the equipment are included in the comparison.

Piping connections are planned for the desired flow direction and volume of circulation, positions for blinds and tie-ins are located and provisions are made for disposal of any hazardous gases evolved during chemical cleaning.

Field control includes filling the equipment, temperature control, titration, disposal of the spent solution, and safety.

Equipment is filled with the solution, and air is bled from heat exchangers and piping to insure complete filling. Temperature of the solution is raised to the recommended maximum efficiency range. Solution concentration is titrated at regular intervals to check progress of cleaning and to know when cleaning is complete.

Spent solution is disposed of as directed by the utilities department. Plant safety rules are observed while circulating the hot chemical-cleaning solution.

Refineries use chemical cleaning to cut turnaround times, boost heat-transfer coefficients, and save wear and tear on equipment.

In-place chemical cleaning is done with the equipment offstream in most cases. It can be done during a turnaround of the refinery unit, or while the stream is diverted through spare equipment. Because chemical cleaning can be done in less time than mechanical cleaning, there is less chance for the spare equipment to fail before finishing cleaning the other equipment.

Better materials of construction. The equipment available now for refinery use is much more durable than previously. For example, thermal cracking units of 20 years ago had short runs and corrosion was severe. Now, operating conditions in catalytic crackers and reformers are much more severe and runs are much longer.

More durable pumps and other mechanical equipment are in use at higher operating temperatures than ever before. Mechanical seals have taken over from packing in most difficult of applications. Also, steels are much stronger, more weldable, and corrosion-resistant.

Corrosion inhibitors. Corrosion inhibitors have eliminated many corrosion problems in refineries and are widely used. They are especially useful in controlling sulfide corrosion in overhead systems of crude-distillation and vacuum towers. The gas plants of catalytic crackers are almost free from sulfide corrosion.

Corrosion inhibitors are surface-active agents and also contribute to reduced fouling in equipment. Thus, corrosion is less and the inhibitors help keep fouling deposits from adhering to the equipment walls.

Patch kits. Corrosion-resistant polyesters and epoxy resins combined with glass cloth give refineries another tool to extend onstream time without sacrifice of safety.

Many times these patch kits can be applied while the equipment remains in operation.[7 8] Corroded storage-tank roofs and walls can be repaired while the tank contains liquids. No sandblasting is required to apply the patch kits.

Loose paint is scraped from around the corroded area. Glass cloth or wire mesh is saturated with the resin and laid over the corroded area. A top coat of resin is applied with a trowel or stiff brush and the patch is cured at ambient temperature.

Externally corroded piping is wrapped with glass cloth saturated in resin and cured at atmospheric temperature. Surface preparation by sandblasting may be used to prepare the pipe surface and provide a good adhesion between the resin and pipe. The wrapping is cured at ambient temperature.

Patch kits stop external corrosion and extend the life of corroded equipment without a shutdown for repairs and replacement.

Photography is shortening drafting time for capital and maintenance jobs. Photographs are used extensively for piping drawings of capital expansions by major engineering-contractor companies.

Photographs give a vivid picture of the installation to all personnel. Perspective is one drawback which makes it difficult to scale directly from a drawing. Now equipment is made that takes the perspective out of photo-

CRITICAL-PATH PLANNING is new technique for finding most economical time schedule for turnarounds and construction projects.

graphs and promises even more utility for photography.[9]

Photography of plant-maintenance activities gives a permanent record of repairs, failures of equipment, and when given to craftsmen show the location and extent of work.[10]

How to apply machine methods to maintenance. Refiners are using more machine methods in maintenance. Machine methods help tabulate the daily volume of records, plan the details of turnarounds, and expand the usefulness of maintenance records.

Time records are tabulated almost universally by machine methods. The area foremen complete time sheets at the end of each day for all men who worked for him. The time sheets for each man show work-order numbers and hours of each job he worked on that day. Work-order numbers and account numbers are crossindexed and machine methods distribute the charges to the correct account.

Accuracy is one of the prime needs of reports coming from area foremen. One way to improve accuracy is to cut the number of reports. One refinery has area foremen report only the changes made to the schedule.

Manpower - allocation studies are made in conjunction with linear programing of crude and product runs. The data from these schedules guide the zone maintenance scheduler in daily planning and scheduling.

Refiners are turning to machine methods for keeping warehouse stock records. These programs carry the inventory of stock materials, record receipts and withdrawals, and write purchase orders when minimum stock levels are reached.

The purchasing agent then can concentrate upon the purchase orders that require bids and quotations. Machine methods help reduce the amount of stock material by faster handling of records and purchase orders, and easier screening of slow-moving items. One refiner reports over 30% reduction of spare parts after machine methods were adopted.

Refiners are not using machine methods for daily maintenance scheduling. One reason is that machines and programs embodying the size and logic for the problem are not ready. Also, there would be almost no saving in manpower and time, and the machine programs would take from the scheduler some of the decision-making knowledge developed by long experience.

Further, every time an emergency occurred, the whole schedule would need reprocessing by the machine. Now, the schedule is altered quickly by a conference between the scheduler and the foremen by making a few changes.

Machine logic is not developed for making a linear program take a small change of input and answer with a small change in output.

One of the basic difficulties of adopting machine methods for daily maintenance scheduling is the continuous nature of maintenance. The start and finish of individual jobs are blurred by many other simultaneous events. However, machine methods are available for detail study of scheduling and planning an individual maintenance or construction job.

Critical-path scheduling is the new technique for finding the most economical time schedule for turnarounds and construction projects.[11] Many refiners are adopting it. It locates the steps of the job in sequence that take the longest time from start to finish. It shows which steps to expedite to keep the job within the allocated time.

It is divided into three phases: arrow diagraming, computation, and linear programing.

Arrow diagraming is to write each step to do the complete job and to put these steps together in a logical sequence on a diagram using arrows to represent the steps. Computation of the critical path is made with matrix algebra using standard times for each step. Linear programing considers the time-cost relationship of each step to calculate the cost of the complete job, and compares this cost with lost production cost to find the most economic time.

Refineries are planning the details of turnarounds and construction projects using critical-path planning. The results of critical-path planning of an individual turnaround are easily adapted into over-all maintenance scheduling by present manual methods.

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REFINERY MAINTENANCE ..What it costs

REFINERS are reducing maintenance costs for keeps. The big reduction began in 1958 when economic conditions forced a drastic trimming.

The philosophy used in the reduction was that labor and matrial costs are related. When labor costs are cut, material costs decrease also.

Refiners hastened to make the personnel cuts by layoffs and early retirements. The maintenance policy became that of doing only the amount of maintenance necessary to keep the plant operating. Any work that could be postponed was put off.

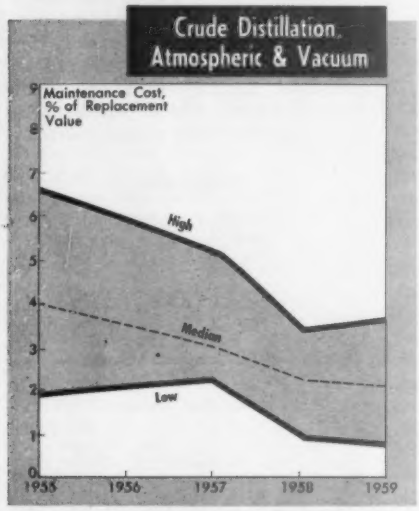
However, if postponed maintenance is not done sooner or later, unscheduled shutdowns and higher work loads occur. The only way to keep the refinery's maintenance costs at low levels was to raise maintenance efficiency.

Refiners sought to raise maintenance efficiency across the board. Organization was revamped. The foremen and craftmen were relieved of many administrative details to permit more concentration on their special maintenance skills.

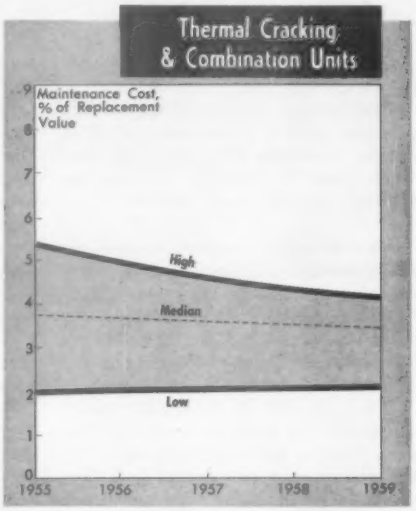
Investments have been made in tools and equipment to help the craftsmen work more efficiently. In-place and hot-shot chemical cleaning have eliminated many manual cleaning chores. The increased use of corrosion probes and inhibitors and surface coatings show the businesslike way refiners are attacking the needless waste of corrosion.

Overtime labor costs have dropped, in many cases to 1.5% of straight time labor. Goals of 1.0% are in sight.

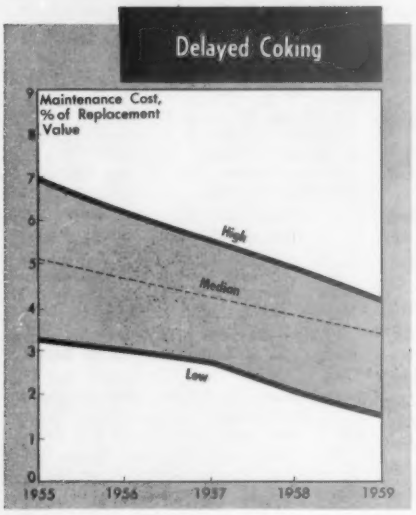
The maintenance organization must have means for the foremen to report simply and accurately the activities of the craftsmen under his supervision.



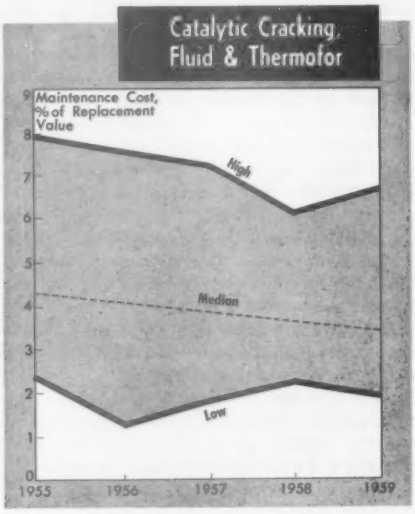
CORROSION inhibitors and probes have lowered corrosion in distillation units. Also, more desalting and pretreating of crudes have helped reduce corrosion tendency of the feed.



MANY cracking and combination units are over 20 years old and are used to process high-sulfur feed stocks.



LOW-SULFUR coke is required by the electrode industry, the primary customer; hence, low-sulfur feed to these units means less corrosion.



CATALYST erosion is still a major problem in catalytic-cracking equipment. Corrosion of fractionators and gas plants has been reduced by inhibitors.

AT COSDEN . . .

After five years' experience in operating Combin-aires, Cosden Petroleum Corporation, at its Big Spring refinery, has installed its FOURTH Hudson Combin-aire.

The Combin-aire is an integrated structure combining a water cooling tower with fin-tube hot fluid to air exchangers. Ambient air is cooled as it is drawn thru the water, and the cooled air serves as the cooling medium for the fin-tube coolers. Thus, with fin-tube coolers, effluent process stream temperatures may be reduced far below those obtained with ambient air.

The Combin-aire may be used primarily as a cooling tower, with the advantages of double use of air, and, because hot effluent air is undersaturated, complete elimination of spray carry over or condensation. Or when water is scarce, or salt, or brackish the Combin-aire may be used primarily for fin-tube cooling, using minimum water of any quality for pre-cooling air.

DEPENDING UPON DESIGN OBJECTIVES THE COMBIN-AIRE MAY HAVE SOME OR ALL OF THE FOLLOWING ADVANTAGES:

- Absolute minimum water consumption consistent with attainment of low terminal process stream temperatures.
- Water circulation may be made automatically responsive to air temperatures with no water circulated except at high ambient temperature.
- No water treatment necessary. Salt water or brackish water may be used.
- No spray carryover or condensation. After passing across the fin-tube elements the heated air leaving the Combin-aire at elevated temperature is undersaturated with water vapor and cannot precipitate condensate or carry water spray.
- Minimum piping. Combin-aire may be installed immediately adjacent to other process equipment.
- Clean air to fin-tube units. During the hot season air is washed, removing dust, sand and insects.

Effluent temperatures of process streams may be accurately controlled with HUDSON Auto-variable pitch fans.

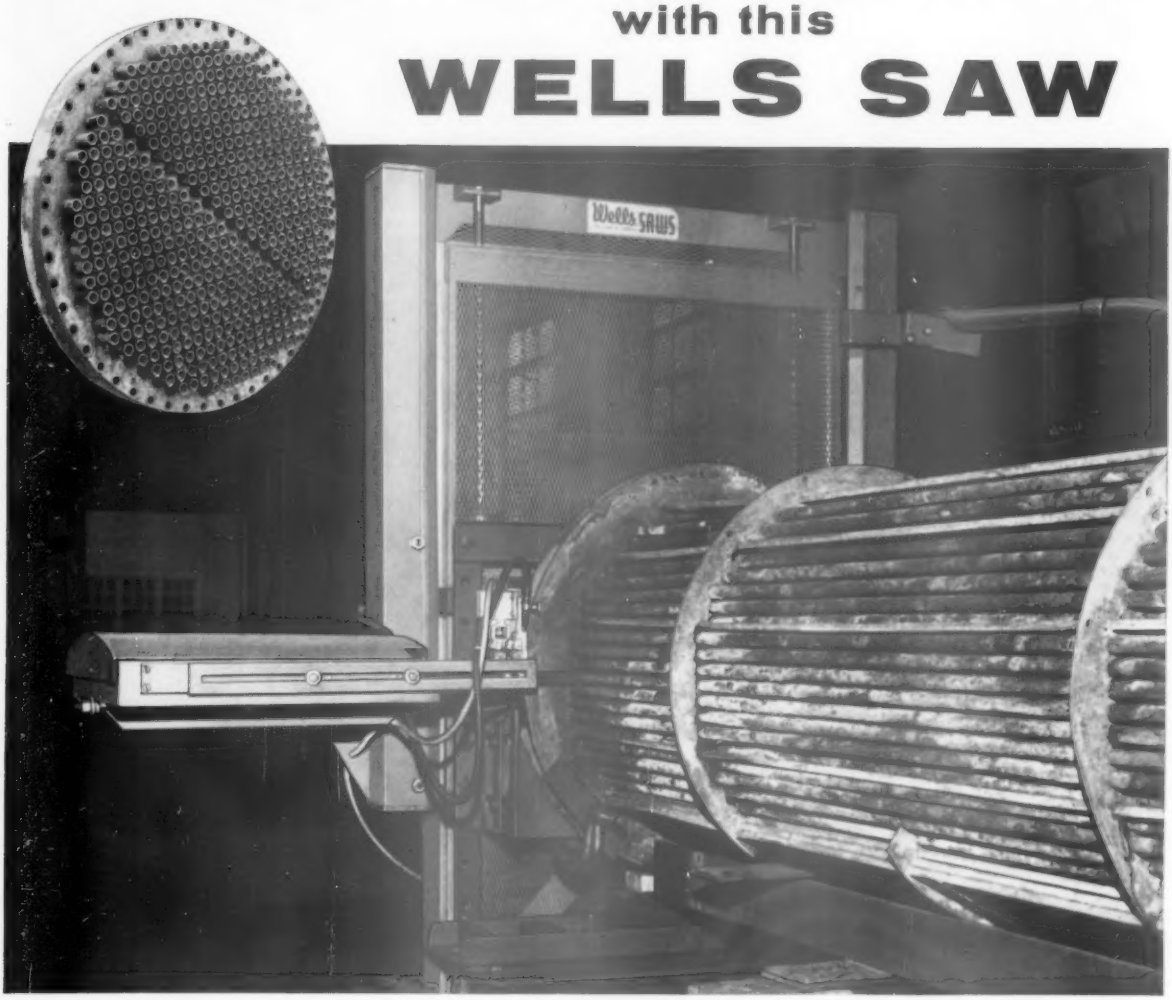
HUDSON

ENGINEERING CORPORATION

BRAEBURN STATION • HOUSTON, TEXAS

OFFICES: 16033 Ventura Blvd. Encino, California • 122 East 42nd St. New York 17, N. Y. • 199 Bay Street Toronto, Ontario, Canada • 17 Stratton St. Piccadilly London W. 1, England • Corrientes 1115 Buenos Aires, Argen. • Rua Mexico 45 Rio de Janeiro, Brazil

Cut Heat Exchanger Tube Bundles SAFELY . . . QUICKLY . . . CLEANLY . . . with this WELLS SAW



TYPICAL OPERATING DATA
(job illustrated above)

Type of Bundle	Debutanizer Condenser
Stationary Head	40½"
Sheet Floating Head	35-11/16"
Head Thickness	3¼"
Type of Material	Brass
Number of Tubes	480
Diameter of Tubes	1"
Gauge of Tubes	14
Type of Material	Copper Nickel
Size of Blades	21'0" x 1¼" x .042"
Teeth per Inch	8
Blade Speed	135 FPM
Cutting Time	165 Minutes

Write for Bulletin SM658 ➡

This is the Wells Model 12-20G-60 in action. Special Heavy-Duty Cut-Off Machines like this, developed by Wells Manufacturing Corporation, specifically for cutting tube bundles, are now doing the job efficiently in many oil refineries and chemical plants.

Model 12-20G makes safe and easy work of this difficult, hazardous, time consuming job, and materially reduces the cost of heat exchanger maintenance.

Standard models are available for cutting 48" or 60" diameter bundles. J.I.C. electrical standards and modifications of basic design are available to meet individual requirements.

If a safer, more practical, less costly method of cutting tube bundles is of interest to you, write for complete information.

Wells SAWS
Wells

The Pioneers of Horizontal
METAL CUTTING BAND SAWS
WELLS MANUFACTURING CORPORATION
840 Service Road—Three Rivers, Mich.

Elaborate machine methods to accumulate and correlate maintenance-cost data are of little value without accuracy at the start. But when obtained and recorded properly, maintenance-cost records are used to study long-term trends, short-term effects, and costs of specific equipment.

These studies show the over-all efficiency of maintenance. Is maintenance doing a better repair job each time or is it slowly falling behind? Average maintenance costs over various time periods give an indication of long-term maintenance-cost trends. A study of daily, weekly, and monthly cost records shows the detail of maintenance costs. It can show the cost trend before, during, and after a turnaround.

Accounting by equipment number shows the maintenance cost of each piece of equipment. Based on the cost trend, disposition of the equipment is easily found. Is it undersized for the job, or is it improperly maintained?

Refiners are reducing the amount of equipment in refineries by building larger-capacity units and thereby reducing both the level of personnel and spare parts.

Measuring maintenance costs. The most useful measure of maintenance costs is as a ratio of direct maintenance costs to capital replacement value expressed in current dollars.

When related to production, maintenance-cost ratios are quite variable depending on throughput for the period. On this basis, maintenance-cost ratios are low when the unit is operated at high rates because only the minimum of equipment can be shut down for repair. But as rates decrease, ratios climb because more equipment can be made available for maintenance.

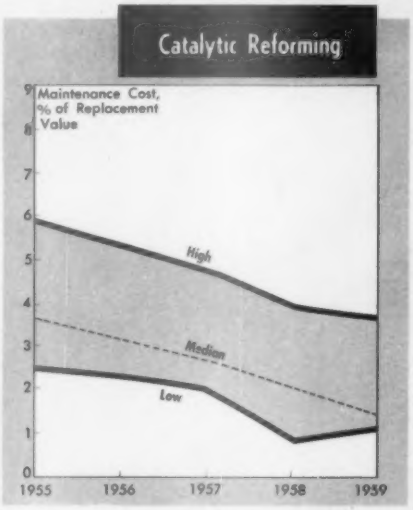
The cost of direct maintenance should include both labor and material. Bale, Mast, and Webster[1], reported in 1956 that total direct-cost ratios ranged from 3 to 5½% for several refineries studied. Individual process installations varied depending upon the severity of the basic process involved.

Here are the maintenance costs for several refinery units. The maintenance costs are shown as per cent of replacement value. They are composed of direct maintenance, maintenance supplies used by maintenance department, and warehouse costs. The costs fall into a band. The band width is influenced by corrosion, erosion, temperature, pressure, size of plants, and cost of plant.

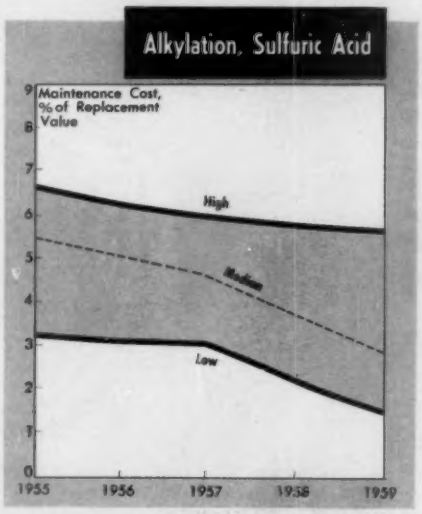
References

1. Bale, E. S., Mast, E. L., and Webster, R. E., "Keep Those Maintenance Costs In Line": The Oil and Gas Journal, Vol. 54, No. 56, p. 112-116, May 28, 1956.

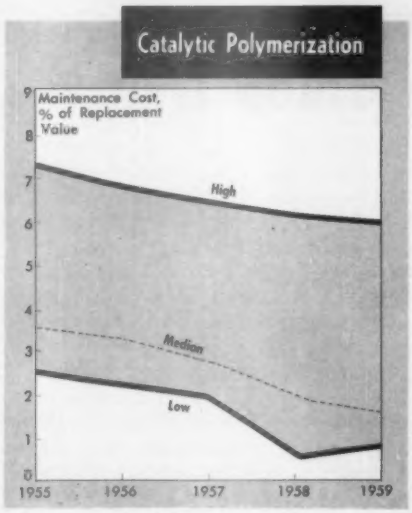
2. Nelson, W. L., "Process-Unit Maintenance": The Oil and Gas Journal, Vol. 56, No. 41, p. 114, Oct. 13, 1958.



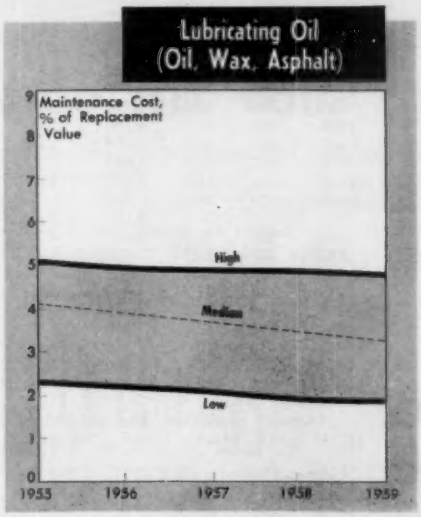
CATALYTIC reforming maintenance costs have been reduced by use of corrosion inhibitors, antifouling additives, and temperature-indicating paints.



ACID CORROSION continues to be a maintenance problem in sulfuric acid alkylation units.



CAT POLY unit operators also find acid corrosion to be a primary maintenance problem.



COMPLETE lube plant has many different units. Some units have high costs; others, low. Corrosive (phenol treating) and foulding (furfural extraction) media are used during processing.

Processing in U.S.A. refineries

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

THE TABULATION on this page indicates the types of processing conducted by the industry since 1889, and the yields of products (especially lubes and asphalt) were indicated in Process Costimating No. 78 (Aug. 29, 1960, p. 103). Treating capacity is not indicated here nor any rerunning operations. The approximate complexity of refining by the method outlined on the Questions on Technology page of March 14, 1960, p. 189, has been about as tabulated below. Most grossly, complexity may be defined as "the times more complicated than simple crude distillation."

1920	5.03
1930	5.57
1940	5.74
1946	6.43
1950	6.59
1956	7.33
1959	8.08

Types of Refinery Processing

	Refineries		Approximate capacity			Approx. capacity of process units, % of crude oil capacity*									
						Thermal				Catalytic					
Year	No.	Ave. BPD (1,000)	Crude oil processed	Nat. gaso. % of crude oil	Equivalent lube crude capacity, %	Crack.	Reform.	Visc. brk.	Coking	Crack.	Reform.	Poly.	Alky.	Hyd. treating	Vacuum
1889	...	...	...	...	35.0	...	...	...	...	...	...	...	...	...	...
1899	...	...	...	...	41.0	...	...	...	...	...	...	...	...	...	...
1904	...	...	...	...	48.0	...	...	...	...	...	...	...	...	...	...
1909	...	...	†501	...	44.0	...	...	...	...	...	...	...	...	...	...
1914	...	...	‡766	...	30.0	2.0	...	...	...	...	...	...	...	...	...
1915	...	...	‡808	...	...	3.5	...	...	...	...	...	...	...	...	...
1916	...	...	‡868	...	...	4.0	...	...	...	...	...	...	...	...	...
1917	...	...	‡988	...	27.0	5.0	...	...	...	...	...	...	...	...	...
1918	...	...	890	0.75	26.0	6.5	...	...	...	...	...	...	...	...	...
1919	...	...	990	0.82	25.0	9.5	...	...	...	...	...	...	...	...	...
1920	373	4.1	1,187	0.73	24.0	13.1	...	...	...	...	...	...	...	...	...
1921	350	5.1	1,210	0.57	23.0	15.6	...	...	...	...	...	...	...	...	...
1922	325	5.7	1,370	0.73	...	18.3	...	...	...	...	...	...	...	...	...
1923	...	...	1,590	1.1	22.0	21.2	...	...	1.6	...	...	...	...	...	...
1924	357	6.9	1,760	2.3	...	24.1	...	...	1.6	...	...	...	...	...	...
1925	360	6.9	2,025	2.7	21.0	27.5	...	...	1.7	...	...	...	...	...	...
1926	352	7.3	2,150	3.6	...	33.0	...	...	1.7	...	...	...	...	...	...
1927	327	8.7	2,270	3.9	...	...	0.5	...	1.8	...	...	...	...	...	...
1928	326	9.3	2,500	3.9	20.0	33.4	0.9	...	...	...	...	...	...	...	...
1929	341	9.7	2,700	4.7	...	35.0	1.3	...	...	...	...	...	...	...	...
1930	358	10.1	2,540	4.6	19.0	37.0	2.0	...	3.0	...	...	...	...	...	0.5
1931	346	10.7	2,450	3.9	...	40.5	2.5	...	3.2	...	...	...	...	...	1.0
1932	365	10.0	2,240	3.1	18.0	40.3	2.9	...	3.1	...	...	...	...	...	1.5
1933	372	9.3	2,360	2.9	...	42.1	3.3	0.5	2.4	...	...	...	...	...	2.0
1934	454	7.8	2,450	3.1	17.0	43.8	3.8	0.5	2.2	...	...	...	...	...	2.0
1935	435	8.3	2,640	3.2	...	47.4	4.1	1.0	2.1	...	...	...	...	...	2.5
1936	422	8.8	2,920	3.2	18.0	48.3	4.2	1.0	2.0	...	...	...	...	...	3.0
1937	423	9.4	3,240	3.3	19.0	46.9	4.3	1.0	1.8	...	...	0.2	...	...	3.5
1938	431	9.2	3,190	3.3	20.0	48.6	4.4	1.0	1.9	0.6	...	0.5	...	...	3.9
1939	435	9.1	3,360	3.1	21.0	45.0	4.5	1.0	1.8	1.5	...	0.9	...	...	4.9
1940	461	9.1	3,540	3.0	22.0	44.1	4.6	1.0	1.6	3.1	...	1.3	...	...	5.1
1941	420	10.0	3,850	3.4	22.0	41.5	5.0	1.0	1.6	3.4	...	1.3	...	...	5.3
1942	430	10.5	3,660	4.2	22.0	39.4	5.6	1.0	1.4	4.0	...	1.4	...	...	5.8
1943	386	11.4	3,920	4.3	21.0	35.8	6.7	1.0	1.3	5.0	...	1.4	0.3	...	5.8
1944	384	12.3	4,550	4.0	20.0	33.6	6.4	1.0	1.5	10.3	...	1.4	0.7	...	6.5
1945	380	13.4	4,700	4.1	21.0	32.7	6.7	1.0	1.6	17.5	...	1.5	1.1	...	8.2
1946	364	14.0	4,740	3.6	21.0	32.9	5.6	2.0	1.8	19.1	...	1.4	1.2	...	9.2
1947	361	14.8	5,070	3.8	21.0	31.7	5.6	2.3	1.9	20.3	...	1.3	1.3	...	10.0
1948	352	16.6	5,610	3.7	21.0	30.3	5.6	2.6	2.0	21.0	...	1.2	1.4	...	10.5
1949	336	18.6	5,320	4.4	21.0	28.6	5.5	2.9	2.1	23.0	0.4	1.1	1.5	...	10.7
1950	320	19.5	5,730	4.5	21.0	26.7	5.5	3.2	2.3	24.8	1.0	1.2	1.7	...	11.3
1951	325	20.6	6,500	4.2	21.0	24.3	5.4	3.6	2.5	26.8	1.4	1.2	1.9	...	12.6
1952	327	21.9	6,680	4.3	19.0	22.0	5.3	4.1	2.7	29.8	2.5	1.3	2.0	...	12.8
1953	315	23.8	7,000	4.4	18.0	19.4	5.2	4.7	3.0	34.2	3.7	1.3	2.1	...	13.7
1954	308	25.2	6,950	4.6	18.0	16.6	5.0	5.5	3.5	33.5	3.0	1.2	2.3	...	15.6
1955	296	27.3	7,470	4.6	17.5	13.9	4.6	6.5	4.2	37.8	7.0	1.5	2.5	1.3	19.2
1956	313	26.8	7,920	4.7	17.0	11.0	4.0	7.4	4.7	41.4	10.3	1.6	2.8	4.8	26.6
1957	304	29.3	7,930	5.2	16.5	8.7	3.4	7.5	5.1	41.6	13.0	1.5	2.9	8.3	27.4
1958	298	...	7,580	5.4	15.3	7.1	2.9	7.3	5.1	43.5	15.8	1.5	3.2	13.8	29.2
1959	293	...	7,960	†5.5	14.5	6.5	2.4	7.0	4.9	45.0	18.2	1.4	3.6	16.9	33.0
†1960	286	†32.8	†8,100	†5.5	†14.4	†6.0	†1.9	†6.7	†4.6	†45.2	†18.8	†1.4	†3.8	†17.2	†34.5

*Asphalt production and finished lube-oil production shown in Process Costimating No. 78, Aug. 29, 1960, p. 103. †Estimate. ‡E. H. Leslie, "Motor Fuels . . .," Reinhold Publ. Co., N. Y., 1925.

IF TIRES COULD TALK THEY WOULD TELL YOU:

"Very close to 50 percent of the butadiene required for synthetic rubber in the U.S. can be produced by plants using the versatile one-step Houdry Dehydrogenation Process.

"And most of this capacity has gone on stream since 1957, based on a background of serving U.S. industry for over 15 years. It is also producing butadiene in Europe, and two additional units will go on stream in Europe and Asia this year."

By direct dehydrogenation of butane, the Houdry Dehydrogenation Process can produce butene as well as butadiene, and produces other mono- and diolefins from the corresponding saturated hydrocarbons. This flexibility allows processors to switch their output to meet changing market conditions, and the changing demands of the chemical industry. Adapting the process to yield a changed end product is simple and economical.

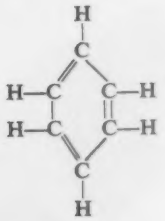
A description of the Houdry Dehydrogenation Process and the economics of its operation will be sent promptly, on request. When you write, you'll find it well worth your while to ask for an up-to-date outline of Houdry services, too.

***HOUDRY**
PROCESS CORPORATION
1528 Walnut Street, Philadelphia 2, Pa.
*Houdry means Progress...through Catalysis

The
FOREMAN'S PAGE

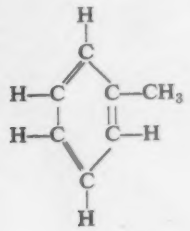
Special benzene properties make aromatics an important branch of hydrocarbon family

ONE particular ring-type compound is so important and has such special properties that it forms the basis for a separate family of hydrocarbons called aromatics. This compound is benzene.



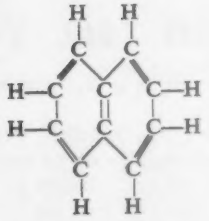
Benzene

All the so-called aromatic streams in the refinery contain either benzene or members of its family such as



Toluene

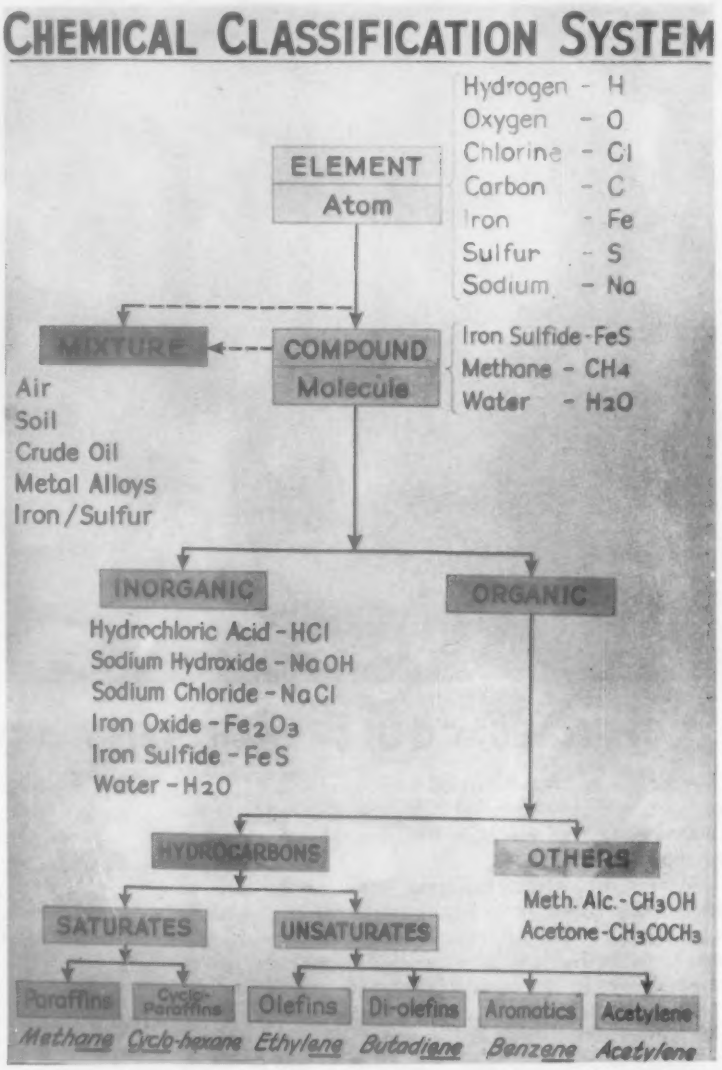
and



Naphthalene

You are probably already familiar with naphthalene without knowing its name. Mothballs are made from this material. Toluene and naphthalene are just a few of the thousands of members of the benzene family.

Remember that aromatics are harmful when breathed or when they contact the skin, and proper protective equipment must be worn.



CLASSIFICATION CHART shows the different families of chemical compounds and how they are related.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Division of Humble Oil & Refining Co.

THINK how sensible it is to use this Gauge Valve and Connector instead of permanently installed pressure gauges. You need only one gauge for an entire lease. Eliminate valve breakage and repairs and insure correct pressure readings always with a single master gauge.

UNIBOLT "PRESSUREMATIC"

It's both a high-low safety and a Christmas tree wing valve

Since economy is the order of the day and safety can never be neglected in any economy, the UNIBOLT PRESSUREMATIC VALVE should be of double interest to production men.

Here is a valve that does the work of two valves yet costs little, if any, more than a good high pressure valve.

The UNIBOLT PRESSUREMATIC VALVE combines all of the time-tested and proven features of the Unibolt Adjustable Wing Valve with a novel automatic actuating accessory. The valve closes instantly when a pre-determined pressure balance across the seat is disturbed. The actuating mechanism consists of a small piston which is exposed to well pressure and a larger piston which is exposed to flowline pressure. A broken flowline or open valve, for example, in the production system, would lower the flowline pressure and thus instantly close the valve. Once closed, the valve may be easily opened and set manually for automatic operation. The downstream or low pressure line may be tapped at any remote point and thus embrace any desired portion of a gathering and treating system. Offshore and other remotely controlled wells could be shut in automatically in case of fire, ship collision, etc. The unique design lends itself to many such applications.

Send for literature or contact your nearest UNIBOLT sales representative.

The regular UNIBOLT Adjustable Wing Valve can be readily converted to "Pressurematic" by replacing the stem/bonnet assembly with the Pressurematic unit.

UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

Automatic vapor-pressure instrument

controls addition of LPG and natural gasoline to crude lines

BY P. R. SCOTT
Chemist, Shell Pipe Line Corp.

CRUDE-OIL PIPELINES have had to accept an increasing amount of volatile natural-gasoline-plant products in recent years. And the resulting vapor pressure of the crude-volatile blends has hampered operations. Revenue loss has been caused by high evaporation losses, spillage from boiled tanks, and the need to maintain high back pressures to prevent pump cavitation.

Various methods have been used to correct these problems. Ratio control has been successful but only where equipment and qualified personnel are available on a 24-hour per day basis. Prearranged volatile pumping rate has also been used but high-vapor-pressure slugs are often formed. Setting the pumping rate at a conservative value helps but does not allow maximum use of the line for transporting volatiles.

A solution has been found in a vapor-pressure recorder-controller. It has satisfactorily controlled the injection rate of butane and other high-vapor-pressure gasoline-plant products into crude-oil lines for some time.

This device was developed on a crude-oil system extending from New Mexico to the St. Louis area. It handles blends of up to seven different crudes and as many natural-gasoline-plant products. Reid vapor pressures of the crudes range from 4 to 7 lb. and of the volatiles, from approximately 13.5 to 65.0 lb.

Increased gasoline injection in this system caused the usual high-vapor-pressure problems: High evaporation losses, tank boiling, and vapor locking. Pumping rates for each injection point were set well below the calculated tolerable maximum and hours for injecting were increased to avoid a reduction in the amount of gasoline products injected. This helped substantially but still was not entirely satisfactory.

A major problem in the transportation of volatiles in crude streams is the occurrence of high-vapor-pressure slugs lasting from 5 to 30 minutes. An unscheduled stoppage or marked slowdown in the flow of the crude while the gasoline injection continues unabated is the principal cause. These slugs may cause boiling within tanks, vapor locking, pump cavitation, and other problems. Ratio controllers at all injection points would correct this problem but not others. And it would not allow maximum utilization since the controller must be preset at conservative levels.

Such slugs have also been caused by the additive effect of two or more volatile injections in the same portion of the crude. Sometimes gasoline-plant pumping rates have been inadvertently set too high. The latter can be caused by using incorrect vapor-pressure values for the crude or the volatile or both.

Effective elimination of all these problems requires an instrument that will continuously monitor the crude stream and control the volatile injection rate to maintain the vapor pressure at a preset value.

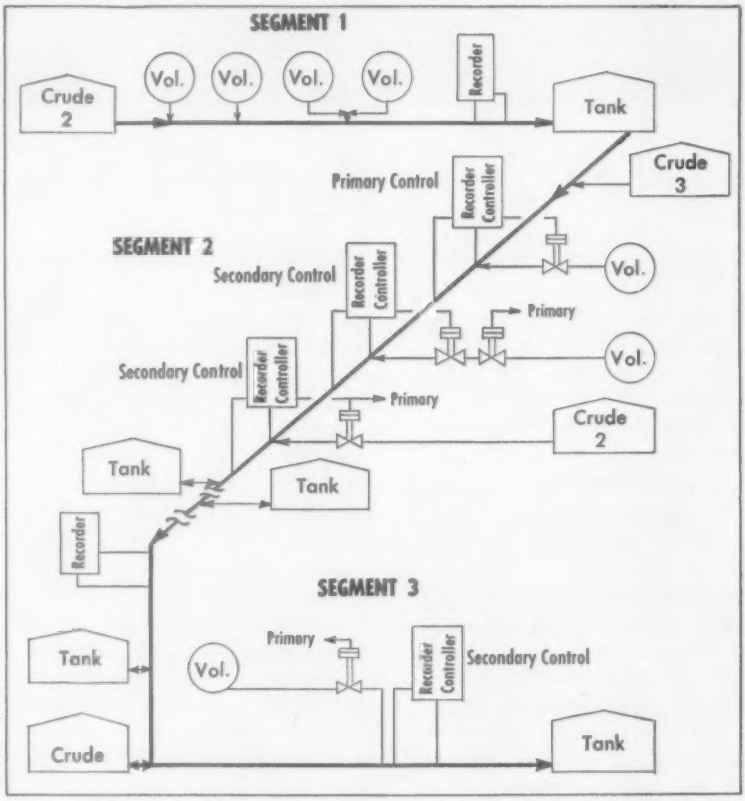
The Test System

Fig. 1 is a simplified flow diagram of the crude system. Volatile-laden crudes fill approximately 100% of the available space in Segment 1, 30 to 40% in Segment 2, and approximately 55% in Segment 3.

Four volatile injections in the first segment bring the Reid vapor pressure of the crude-volatile blends to about 10 lb. during the winter months and the volatile content to as much as 9% volume.

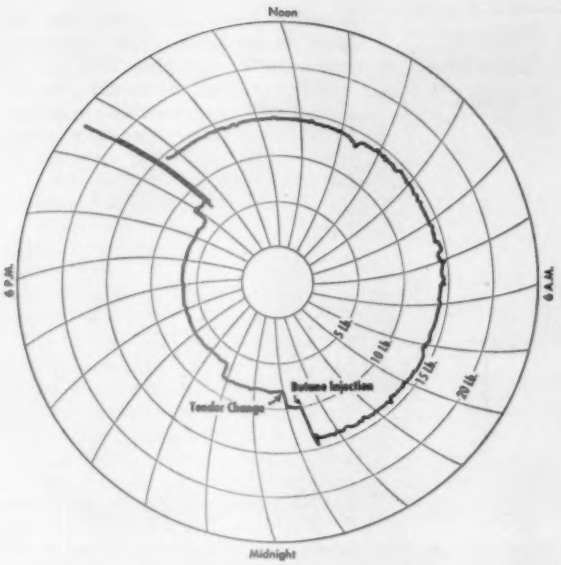
Gasoline-plant products are injected into the volatile-laden crudes at two locations on Segment 2. The injection of relatively large amounts of 65-R.v.p. butane at the first location is of primary interest. A vapor-pressure recorder-controller was installed here to record the vapor pressure of the crude-butane blend and to indirectly control the butane injection.

The injection of a gasoline, with an

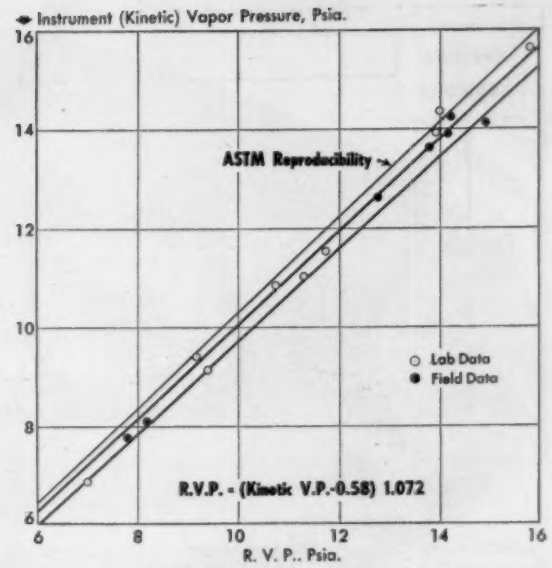


VOLATILE INJECTION and control points in crude system. **Fig. 1.**

Paper presented at ASME petroleum mechanical conference, New Orleans, September 19-21, 1960.



LOCATION of vapor-pressure recorder-controller in sample system. Fig. 2.



TWENTY-FOUR-HOUR RECORD of controlled volatile injection. Fig. 3.

R.v.p. of 32 lb., at the second location increases the volatile content of portions of the tenders to 12% or more during the fall and winter months. A second recorder-controller at this location limits the volatile injection rate only when the vapor pressure of the main stream exceeds a preset value; otherwise, the injection is controlled by other means. Farther downstream a third recorder-controller can be used to increase the injection rate of a low-vapor-pressure crude if the main-stream vapor pressure exceeds the maximum permissible value.

Portions of the volatile-laden tenders go into tankage at two stations on Segment 2. Normally the major portion is tight lined from one end of Segment 2 to the other. The same portion of a tender does not necessarily go into storage at both locations.

The volatile-laden tenders ordinarily go into storage at the end of Segment 2, but at times go directly to Segment 3.

Installation of controller. Control of the butane injection in Segment 2 alone was not sufficient to permit maximum utilization with safety since the 32-lb. gasoline injection was downstream. Both have to be controlled to secure the desired results.

Despite this, the butane injection on Segment 2 offered ideal conditions for evaluating the experimental vapor-pressure recorder-controller. An unlimited supply of butane and adequate pump capacity assured sufficient butane to raise the vapor pressure of the lowest-vapor-pressure crude to the highest desired value. Equally important was the fact that the volatile-laden tender would include two to four crudes with variations in R.v.p. values °F. from 4 to 12 lb.

Butane was injected into the side of the 20-in. crude line through a standard 4-in. welded flange connection. An air-to-open pneumatic valve, operated by the recorder-controller, was installed in the 4-in. line approximately 60 ft. from the injection point. A ¼-in. sample tap (through ¾-in. fittings) was made in the top of the crude line 25 ft. downstream from the injection point.

To reduce the time lag, small-volume piping was installed to supply the slipstream to the instrument. A small quantity of the blend traveled from the injection point to the sensing element within the vapor-pressure instrument in 20 to 25 seconds.

Calibrating the instrument. The interval between the opening of a plug valve on the injection line and a vapor-pressure change indicated by the instrument varied from 18 to 25 seconds.

A direct calibration of the instrument was made in the field. Samples were taken on the line supplying the instrument. The instrument reading was recorded at the same time the sample was taken. The two were compared and a calibration curve was drawn from data for various crudes.

R.v.p. values for samples from the instrument supply line were compared with samples taken 7.15 miles downstream to see if the sample line was properly located. Agreement of the samples indicated the sample stream represented a homogeneous blend of the crude and butane when the butane was less than 2.7% volume. At higher percentages of butane the vapor pressure of the sample stream was too high.

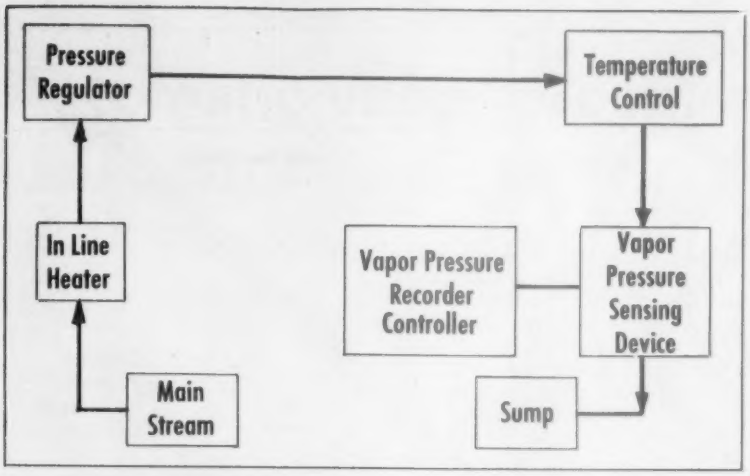
The limited data available indicate that the difference increased in a linear manner from zero for 2.5% butane blends to 2.1 lb. for 6.9% butane blends. The sample tap was later moved 45 ft. downstream from the blending point and 45° below top center. Tests indicate that for one instrument this placement is satisfactory up to 5% volatile blends while for another instrument it is not. Mixing nozzles equally spaced around the main line should be installed provided no other fittings are used to increase mixing.

Safe vapor-pressure limits. To get maximum use of the volatile-laden crudes in transporting the volatiles injected in Segment 2, it was necessary to establish maximum permissible vapor-pressure limits and to control the injections to maintain these limits.

Study of a high-vapor-pressure volatile tender (15.8 lb. R.v.p.) was made. This study and later operating experience showed that crude with an R.v.p. of 16.0 lb. could be transported with no unusual operating problems provided: (1) that line and tank temperature are 80° F. or below, (2) that the atmospheric pressure at breakout tankage exceeds 13.5 psia., and (3) that floating-roof storage tanks are used. These findings are consistent with those reported in API Bulletin 2513.

Operating Experience

The field installation of the experimental recorder-controller was com-



REID VAPOR PRESSURE vs. instrument vapor pressure. Fig. 4.

pleted several years ago. It satisfactorily controlled the injection of the butane to maintain the R.v.p. of the crude-volatile blend with ±0.3 lb. of the selected vapor pressure.

Because of a faulty pump arrangement, pressure at the control valve varied by as much as 100 lb. when the injection rate changed. Despite this radical variation the instrument controlled the injection to maintain a uniform vapor-pressure blend.

Fig. 2 is a 24-hour record taken from the recorder-controller. At 3:30 p.m. recorder was tested and put on stream. The index was set at 14 lb. Vapor pressure was recorded until approximately 1:30 a.m. of the next day. Then the block valve on the injection line was opened and pumps at the gasoline plant started. The instrument controlled the butane injection rate to maintain the desired vapor pressure in the crude line. The data for this 24-hour run are:

Time	Average Injection Rate, bbl./hr.
1:25- 2:30 a.m.	253
2:30- 4:30 a.m.	302
4:30- 6:30 a.m.	148
6:30- 8:30 a.m.	240
8:30-10:30 a.m.	253
10:30-12:30 a.m.	301
12:30- 2:30 p.m.	262
Average to 3:45 p.m.	252
Calculated average based on vapor pressure of various crudes and butane	260
Crude flow rate, bbl./hr.	9,350

Improved operation. The instrument's operation improved and vapor-pressure variation was reduced to less than ±0.3 lb. after the pumping arrangement was revised and the pressure-control system improved at the gasoline pump station.

Since control was now available, the shipper requested that each tender be blended to the same vapor pressure. A vapor-pressure setting was calculated using the vapor pressures of the various crudes, the average volume of crude available per day, the average vapor pressure of the butane, and the desired butane shipping rate.

The recorder-controller was then set at the calculated value. It controlled the butane injection rate to give a uniform vapor-pressure blend and kept the average injection rate within 3% of the desired value. The injection rate varied from 140 to 550 bbl. per hour because the vapor pressure of the crudes changed.

Experience gained from this instrument showed that the principle was sound and that similar instruments could be used to monitor and control vapor pressure of various hydrocarbon streams.

Recent experience. The original recorder-controller has been replaced and three others installed on Segments 2 and 3. One of the same basic design was also used to record the vapor-pressure values for crudes in the first segment. It is necessary to know the vapor pressure of this crude to calculate the maximum amount of butane and gasoline that can be injected into Segment 2 if the recorder-controllers are inoperative.

After the normal startup period, the instruments worked satisfactorily. On occasions they prevented high-vapor-pressure slugs. Approximately 45,000 bbl. more of butane were shipped during October and November than could be expected. This increase was attributable to the control of vapor pressure and higher vapor-pressure limits.

How It Works

An especially designed ejector, shown in block form in the flow diagram, is the heart of the vapor-pressure recorder-controller. (See Fig. 4). This device is approximately 1 by 2½ in. All other components are present to maintain the proper flow conditions, record the ejector pressures, interpret them, and reestablish this pressure should it deviate from the desired value.

The instrument first heats a sample of a well-mixed crude-volatile stream in an in-line heater. A pressure regulator then reduces the pressure so that the vapor-pressure sensing device can function properly. The temperature-control sensing element, adjacent to the sensing device, maintains the sample stream at the proper temperature by regulating the in-line heater through a feedback system. The kinetic vapor pressure of the stream is determined by the vapor-pressure sensing device and transmitted to the recorder-controller. After the sensing device, the sample stream goes to a sump.

Vapor-pressure correlation. The vapor pressure recorded by the instrument is neither the true nor the Reid vapor pressure. A linear correlation does exist, however, between the vapor pressure recorded by the instrument at specific operating conditions and the Reid vapor pressure of the sample stream (See Fig. 3.) The reproductibility for Reid and instrument vapor-pressure values was found to be as good as that for operators using different Reid equipment.

The vapor pressure recorded by the instrument is called the kinetic vapor pressure since the ejector device works on the principle of increasing the kinetic head until the static head at the nozzle discharge reaches the vapor pressure of the liquid.

The instrument's safety system was designed to afford maximum protection to the line receiving the high-vapor-pressure products and to protect the instrument in case of abnormal conditions. If the flow conditions through the instrument are such that its reading is not reliable, or if a power failure occurs, the control valve on the volatile line is closed. When the flow in the main line stops, abnormally high-vapor-pressure blends are formed at the injection point and the instrument closes the injection valve.

Acknowledgment

The author acknowledges the contributions of many Shell Pipe Line Corp. personnel, especially those of C. H. Goodnight. Special appreciation is extended to the personnel of Texas Pipe Line Co. whose cooperation and aid made some of the field studies possible.

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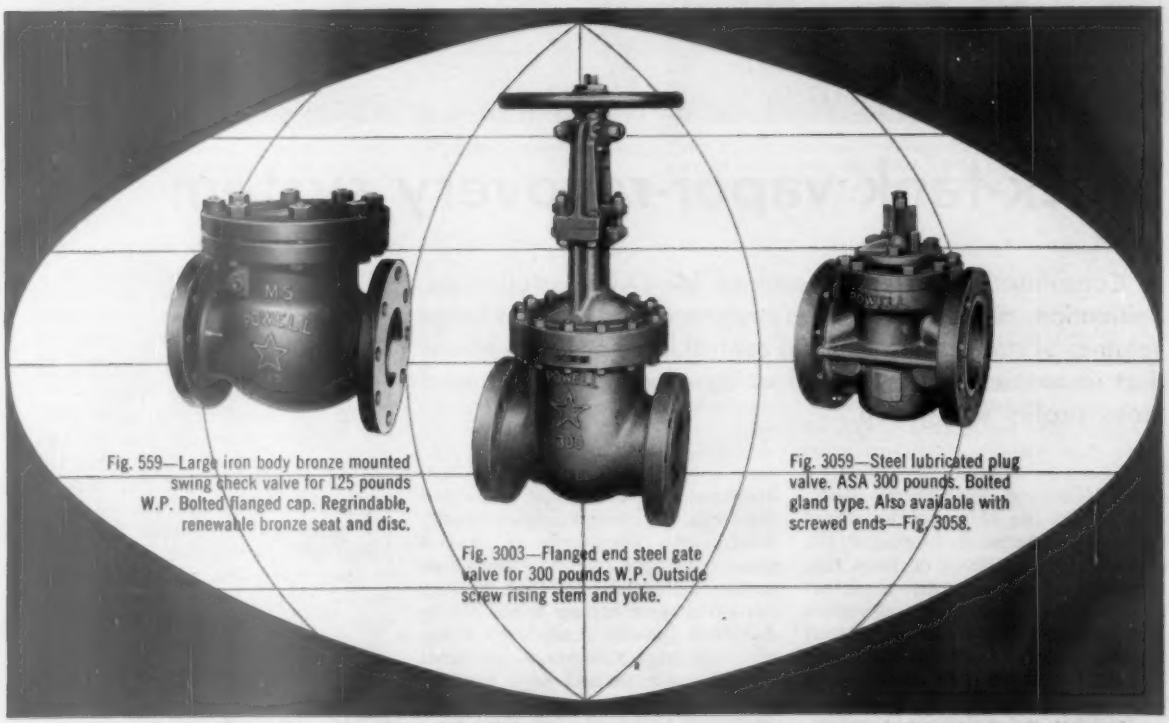

Fig. 559—Large iron body bronze mounted swing check valve for 125 pounds W.P. Bolted flanged cap. Regrindable, renewable bronze seat and disc.

Fig. 3003—Flanged end steel gate valve for 300 pounds W.P. Outside screw rising stem and yoke.

Fig. 3059—Steel lubricated plug valve. ASA 300 pounds. Bolted gland type. Also available with screwed ends—Fig. 3058.

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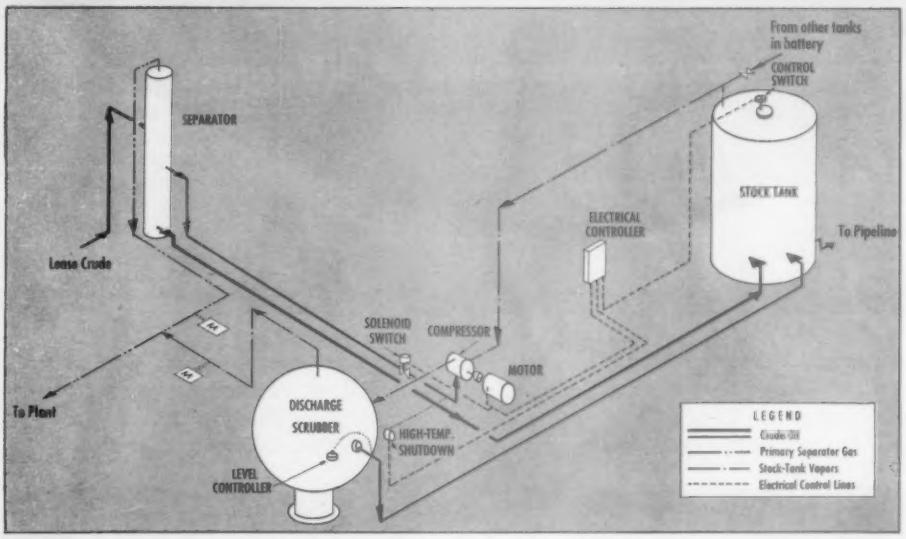


TYPICAL EXAMPLE of the type of installation that can mean real savings in lease operation. Vapor-recovery unit is at center of photo.

FLOW DIAGRAM for a unit like the one above. Tank vapors are compressed and separated in the discharge scrubber. Gas from the scrubber and the lease separator go to a gasoline plant.

What Phillips did in West Texas to develop a practical

Stock-tank vapor-recovery system

• Consolidation of lease batteries for LACT installations, unitization, and cost-reduction programs has brought large volumes of stock-tank vapors to central locations. This means that vapor-recovery systems can now be economical, and lease profits will go up.

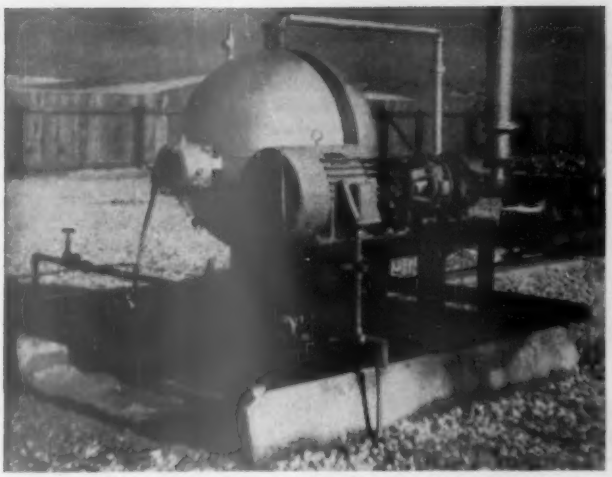
BY R. C. McCUTCHAN
Phillips Petroleum Co.
Odessa, Tex.

RECOVERY of lease-battery stock-tank vapors has only recently stirred up enough interest to investigate the economies of recovery of these rich vapors. Perhaps the most important changes in current lease operation that has contributed to this interest has been the widespread installation of LACT batteries and consolidation of field batteries for unit operations or for labor and maintenance savings.

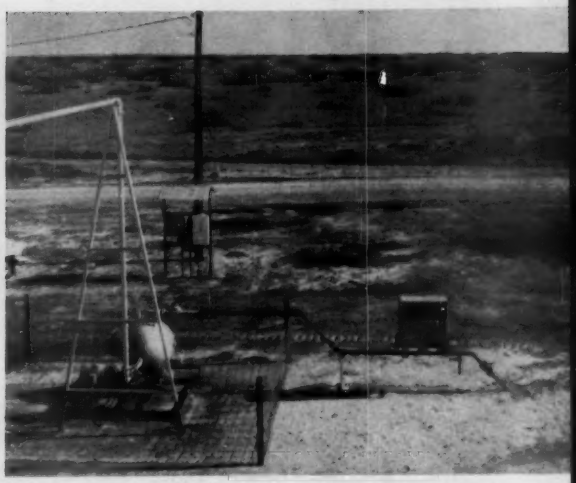
These installations in West Texas, and especially on Phillips' leases, usually involve the combining of several smaller batteries on one lease which results in a total combined oil production at one battery from 500 to 2,000 bbl. per day of crude oil. These relatively large volumes of oil processed through normal lease facilities provide a sizable quantity of rich stock-tank vapors at convenient locations for recovery and injection to gasoline-plant gathering systems.

The first installation in which Phillips became interested was in Lea County, New Mexico, during the latter part of 1956. Since this lease is connected to Atlantic's Denton gasoline plant system, Phillips' gasoline-department participation was limited to observation. The unit is still in operation, though like many new-equipment applications, numerous changes, modifications, and improvements have

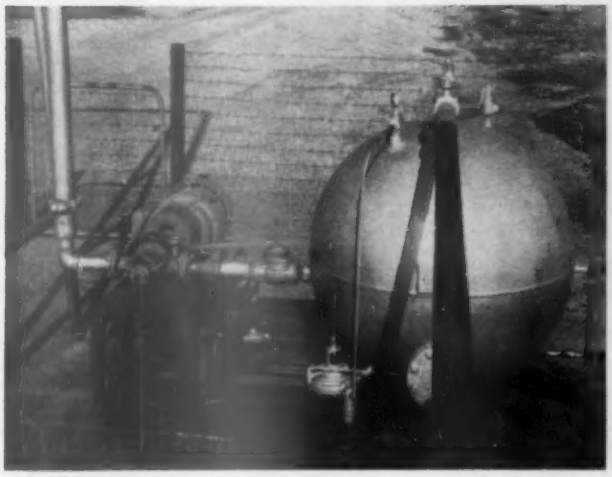
Presented at the API Southwest District, Division of Production Meeting, San Antonio, under the original title "Practical Stock-Tank Vapor Recovery."



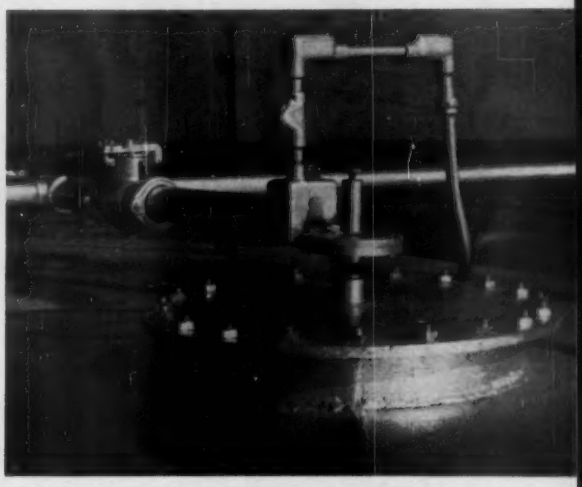
A 20-HP. 130-M.c.f.d. liquid seal compressor on Phillips University lease. This lease is connected to Phillips Goldsmith gasoline plant.



A VAPOR-RECOVERY UNIT on Phillips-Donovan lease in Midland County, Texas. Producing gas-condensate, this lease is connected to Phillips' Spraberry gasoline plant.



CLOSEUP of the 10-hp. compressor on the Phillips-Donovan lease. This unit has a capacity of 50 M.c.f.d.



TYPICAL electric-motor-driven vapor-recovery compressor control switch mounted on a 1,000-bbl. crude-oil storage tank, Phillips-Donovan lease.

been made over the intervening years.

As a result of this initial installation, Phillips' gasoline-department management suggested that the western district investigate the possibilities for installation of vapor-recovery units in one of our plant gathering systems. We solicited the help of the production department in Odessa and were advised of a battery consolidation and LACT installation at the Phillips University lease. This lease is in Andrews County and is connected to the Goldsmith gasoline-plant gathering system.

Producer function. Installation and operation of vapor-recovery equipment may be done by the primary oil producer. Most large batteries will provide attractive economic operation for the oil producer. The equipment is physically connected to and dependent upon the lease operation. The producer may furnish the initiative for these installations.

Compressors. There are several different types and makes of compressors in service on West Texas leases now. Phillips has installed two liquid-seal rotary compressors. Others have used small positive-displacement-type rotary units and reciprocating units, as well as the larger conventional slow-speed reciprocating units. Most of these units are driven by electric motor, either direct-connected in the case of the rotary units, or through V-belts on reciprocating units.

There is no one make or type applicable to all vapor-recovery installations. In specifying equipment for this service, many factors must be considered.

Initially, the problem of liquid condensation in the suction line to the compressor, especially during cooler weather, created hazardous conditions on positive-displacement-type units. Equipping installations with adequate vapor-scrubbing capacity and automatic high liquid-level shutdown equipment will overcome these handicaps.

This condensation in the suction lines resulted in Phillips' selection of the liquid-seal units for the first installations. These units operate with a flow of liquid-seal fluid through the compressor. In fact, the fluid acts as a compression agent rather than the impeller or rotor. It was therefore de-

Congrats and $25 for this quip to J. P. Denny, Phillips Petroleum Company, Box 1351, Odessa, Texas

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cided that operating a unit that could tolerate fluids during compression would offer an advantage over the positive-displacement types. However, Phillips' experience has indicated that these units require approximately twice the horsepower to compress the same volume of vapors through the same compression ratio that is normally calculated for conventional reciprocating units. However, the performance of these units has been trouble-free and they require little, if any, attention for operation and maintenance.

The first unit used produced crude oil for seal fluid. The unit is piped to obtain the crude-oil seal fluid directly from the separator upstream on the level-control dump valve in order to have the full 20 to 25 psi. separator pressure available for flow of this fluid to the compressor. Seal fluid is commingled with the vapors into a discharge scrubber where it is automatically separated and trapped into the fill line from the separator to the lease storage tanks. This arrangement has proved reasonably satisfactory although fouling in the liquid filter screen ahead of the compressor requires periodic attention to prevent frequent shutdowns from overheating.

Time has proven this is not true. We have substituted H_2O for the 55° fluid as the unit would not operate satisfactorily. We now are limiting the seal fluid gravity to 48° API.

Due to the comparative inefficiency of the liquid-seal compressors, Phillips plans to make trial installations in West Texas of positive-displacement reciprocating or vane-type rotary units with appropriate safety controls.

Phillips' production department now has 12 positive-displacement reciprocating-type units operating in the Four Corners area. However, for capacities exceeding 150 M.c.f.d., it is planned to install the larger slow-speed reciprocating units. The flexibility provided in these units for operating through a wide range of capacity and pressure demands by altering clearance could possibly result in standardizing on one make, size, and type for the majority of these larger installations. This, of course, will simplify both the operation and maintenance and reduce over-all costs.

The distinction made here between high-speed and slow-speed reciprocating units has been intentional. The small high-speed units, 600 r.p.m. and over, have only recently been improved to provide a satisfactory unit for continuous, full-load operations. Improvements in lubrication and installation design to eliminate or reduce the high-frequency vibration have made these units more acceptable for these isolated field applica-

tions. Present installations in West Texas utilize an automatic liquid blowcase on the inlet scrubber and many have bypasses between the discharge and suction to allow continuous operation. The latter, while reducing the frequent start-and-stop overloading on the electrical system, could result in excessive power costs in the event the unit is oversized. Phillips has tended to undersize the units in order to provide continuous full-load operation and reduce power waste.

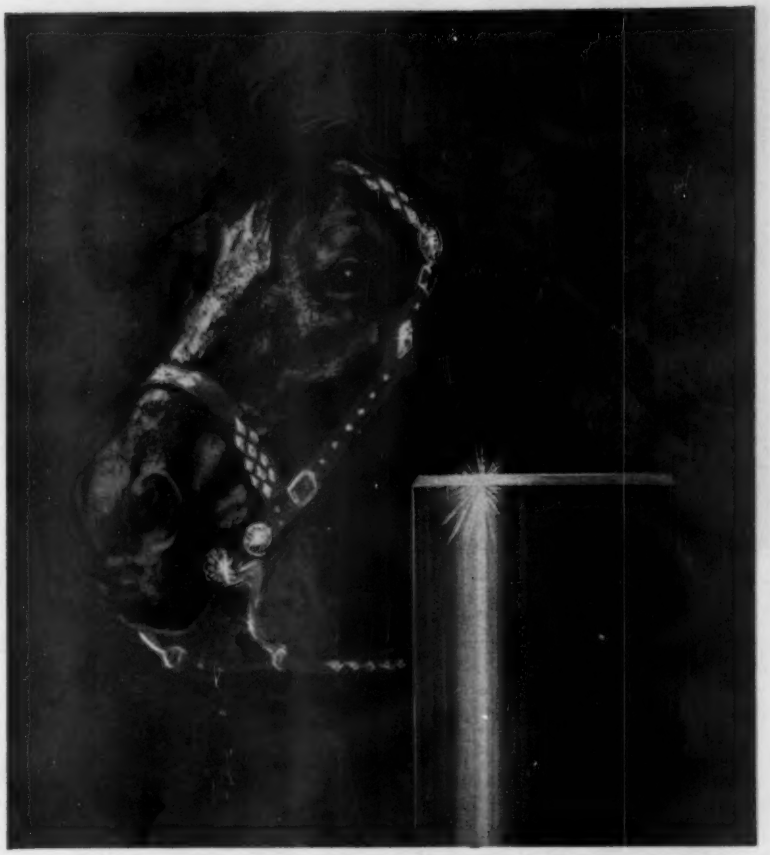
Compressor drives. The only driver utilized by Phillips has been the electric motor, because of its advantages over other types. Operation, maintenance, and the simple, inexpensive safety and control devices applicable to the electrical controllers offset some of the advantages of other types of drives. Installation of automatic batteries and the reduction in manpower in isolated lease locations make this a prime consideration in selecting driver units. Also, the relatively wide use of electricity on West Texas leases usually provides an adequate and economic source of power.

Internal-combustion engines should certainly be economical, and particularly so if sweet lease residue gas is available for fuel. However, this type of drive requires frequent operational checks and periodic major maintenance.

The efficient small gas turbine might have special applications. Continued search for a gas turbine indicates that these units are on the expensive side. One manufacturer is currently prepared to furnish an ejector for this application and if its claims on efficiency prove out, this type of unit may prove satisfactory for leases without electric power available. Phillips considered such a driver unit on one lease where multistage separation was installed. It was planned to take a sidestream of high-pressure gas through the turbine and exhaust it into the low-pressure gas system. A brief and inconclusive survey of West Texas supply and manufacturing firms did not indicate such a turbine available at that time. However, in any future installation with similar lease-operating conditions, it is planned to make a more extensive search for such a driver unit.

If a small, 5 to 20-hp., efficient, compact unit is available, this would provide, in our opinion, the ideal driver for the rotary compressors.

The word "efficient" is especially significant in these applications as there are usually several cents per M.c.f. differential paid between the high and low-pressure gas. Therefore, a turbine-driven unit will have to obtain maximum horsepower conversion



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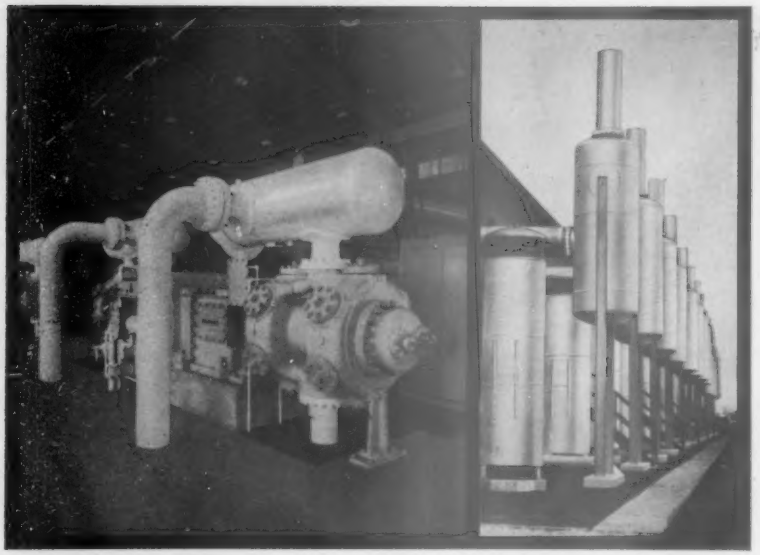

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to justify its installation and operation.

Economics

The over-all economics for these installations are based on the casing-head-gas contract between producer and plant operator, which covers the leases from which the stock-tank vapors are recovered.

The data required to evaluate and write specifications for these installations consist of measuring the volume of stock-tank vapors and obtaining the hydrocarbon content. A standard orifice well tester is installed on the stock-tank vapor line and the volume of vapors escaping are measured. With this record of volume and also the oil production during this period of measurement, a stock-tank gas-oil ratio is established. This ratio can then be applied to normal lease production rates, taking into consideration allowable changes and future lease development and projected changes in surface operations.

It should be emphasized here that caution be exercised and that these ratios cannot be indiscriminately applied. Our tests show that not only reservoir conditions but surface operations, production rates, etc. apparently will vary not only the stock-tank-vapor volume but also the heavy-hydrocarbon content.

The hydrocarbon content of the vapors is obtained by the standard test-car compression method.

Once this information is available, the price paid to the producer is computed under the casing-head-gas contract under which the stock-tank vapors are being sold. During a certain month the Phillips Donovan lease produced approximately 46 M.c.f.d. of stock-tank vapors with a 6.8 gal. per M.c.f. which were processed at the Phillips Spraberry gasoline plant. Under the terms of Phillips' form of casing-head-gas contract, which Phillips uses to purchase casing-head gas for its Spraberry gasoline plant, the Donovan lease would receive approximately $14.38 per day for the 46 M.c.f. of stock-tank vapor.

Conclusions

The continuation of the present trend of battery consolidation and lease automation will provide the necessary volumes and contents in most instances to make a profitable installation for the producer. This additional income, normally a total loss, becomes especially attractive in these times of reduced allowables, increasing costs, and shrinking profits.

It is believed that the oil producer will find the gasoline-plant operator eager to cooperate in furnishing any reasonable test data required for evaluating these installations.

INJECTION TRUCK for anhydrous ammonia is a newly designed compact and mobile unit. Fig. 1.

Anhydrous ammonia can halt internal casing corrosion

• Here's how a major producer of crude oil stopped internal casing corrosion at a fraction of the cost of a well-repair job. Averaging only $50 per well per year, this method is simple and nonhazardous.

BY R. C. LONCARIC, D. R. ANTHONY, M. D. FOLZENLOGEN AND FAIR CALVIN
Atlantic Refining Co., Dallas

INTERNAL CASING CORROSION above the fluid level is due to low pH, and is caused by dissociation of acid gases dissolved in condensed water.

When the conditions that cause corrosion are known, the simplest attack on the problem is to change those conditions. If the environment were changed from acid to alkaline, the availability of H^+ ions would be reduced, and the corrosion would be checked. Starting with this theory, Atlantic Refining Co. attacked casing corrosion in West Texas by scheduling lab and field tests to find out what the results would be.

Because of physical and chemical properties, and considering economics, anhydrous ammonia appeared to be a suitable inhibitor for this purpose.

Presented at the national meeting of the National Association of Corrosion Engineers, Dallas, 1960.

Major problem at the beginning of the large-scale program after the initial tests were completed was the design of suitable injection equipment.

The ability to treat a large number of wells with a minimum of personal hazard was the big requirement. Injection equipment used in experimental work was awkward and time consuming. It was unsuitable for a large-scale program.

A newly designed compact and mobile unit shown in Figs. 1 and 2 proved safe and satisfactory for this purpose.

The mobile unit has three main sections: An ammonia reservoir and pump intake system, a glycol-storage tank and nitrogen-pressurizing system, and a calibrated gear pump and high-pressure injection and venting system. It has all the necessary equipment to prevent injury to personnel by contact with ammonia. The high-pressure and intake sections of the injection truck are kept separated.

Operators of this unit were coached in the hazards of using anhydrous ammonia and high-pressure equipment. An operator's manual was prepared to serve as a guide in the operation and maintenance of the equipment.

After the injection equipment was in use, it was observed that the high-pressure gear pump occasionally vapor locked. This was due to ammonia vapor forming in the pump intake lines. In order to prevent this, the feed lines to the pump are cooled in summer and the ammonia cylinders are heated with exhaust gases in the winter. In this way the vapor pressure of the ammonia in the cylinders is always higher than that in the feed lines. Besides this, there have been no other problems.

Wellhead equipment. All wells on the program were equipped with a hammer union and blanking plug

Anhydrous ammonia: pro and con...

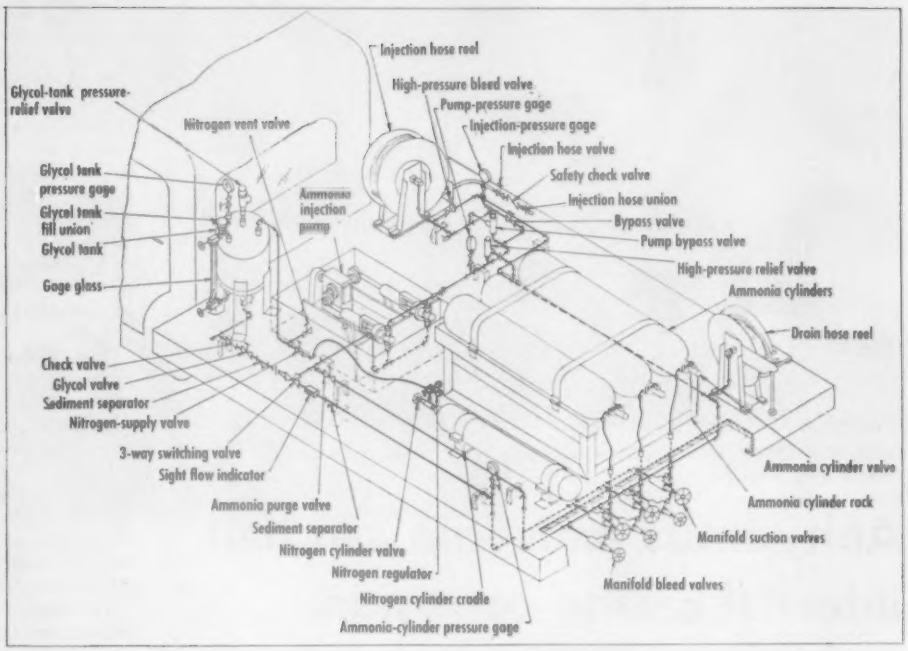
Three years' experience with these treatments shows that anhydrous ammonia has these advantages and disadvantages:

Advantages

1. With proper injection equipment, treatment is fast, simple, and nonhazardous.
2. Treatment does not interfere with any operational procedures, such as pulling tubing or converting to artificial lift.
3. Anhydrous ammonia injection is the most economical method to use on unpacked flowing wells, when the number of wells on the program is 20 or greater. Otherwise the cost of treatment approaches that of the inhibited-oil wash treatment.

Disadvantages

1. Anhydrous ammonia injection is not successful in wells with leaks in flanges, valves, or other parts of the wellhead equipment.
2. Injection of ammonia cannot be used on wells where intermitters are used or on wells with an open annulus.
3. Care must be taken to exclude oxygen from the annular space, since it will oxidize NH_4HS to $(NH_4)_2SO_4$. This salt can be very corrosive to the casing wall since it hydrolyzes to ammonium hydroxide and sulfuric acid. This acid apparently proved extremely corrosive in vapor spaces of some field tanks.



MOBILE unit has three main sections: an ammonia reservoir and pump intake system, a glycol-storage tank and nitrogen-pressuring system, and a calibrated gear pump and high-pressure injection-and-venting system. Fig. 2.

tapped with ½-in. pipe thread, and a ½-in. bleed valve. This setup permits rapid hookup to the wellhead and speeds up injection. The injection of ammonia is done by setting the engine speed and then pumping for a given length of time. The engine speed and time determine the weight of ammonia injected. Ammonia enters the well as a liquid at a pressure approximately 200 psi. greater than casing pressure. After use, the injection system is purged with glycol to sweep out any air and water in the lines.

Total cost of the equipment was $7,000. Approximately $2,500 of this was for the truck chassis.

Injection frequency found. Experimental field work had shown that an average well in Wasson field, 3 months after a 30-lb. injection, still had a wellhead ammonia concentration of 5%. Data on the distribution of ammonia in the well after 3 months showed that for this period, wells were protected below the zone of most corrosion. Using this information, it was decided to treat all wells on the program with 30 lb. of ammonia at 3-month intervals. However, this was reduced to 25 lb. for practical reasons. Commercial cylinders of ammonia hold approximately 100 lb. Using 30 lb. per well, only three wells could be treated from one cylinder, whereas an additional well could be treated with an injection of 25 lb. per well.

Initial injection of ammonia took place in November 1956. Approximately 90 wells were treated with 25 lb. each. Three months after the first injection, the concentration of ammonia in the wellhead gases of all wells was determined. The majority of the wells had ammonia concentrations over 5%. This indicated that these wells could be adequately protected for 3 months with a 25-lb. injection in each well.

A few wells showed no ammonia at the wellhead after 3 months. This was attributed to leaks in casing wing valves, flanges, tubing joints, or to the use of intermitters. In the majority of cases the leaks were stopped by replacing wing valves or tightening flange bolts and discontinuing the use of intermitters. In a few wells, the leaks could not be stopped. Since these were old wells and likely to go on pump in the near future, we did not try to rectify the loss of ammonia in them.

All wells with the exception of a few which contained over 10% ammonia in the casing were reinjected with 25 lb. after 3 months. We felt that the wells with over 10% ammonia would be safe for an additional 3 months without further injection.

Prior to the third scheduled injection, the wellhead gases of all wells on the program were reanalyzed for ammonia and acid gases. The results showed that the majority of wells which had been injected twice had ammonia contents higher than that during the previous test. This showed that ammonia was being added faster than necessary to maintain protection. Consequently, all wells which had over 5% residual ammonia after two 25-lb. injections or after one 25-lb. injection in 6 months were not treated on the third injection date. All others were given the usual 25-lb. injection.

Further tests shortly before the fourth injection date (9 months after the first injection) showed that the optimum period for a 25-lb. injection was about 6 months.

In all of the tests, no acid gases could be detected at the wellhead when the free ammonia concentration was above 1%. But both the ammonia and the acid gases were found in the casing when the ammonia concentration was less than 0.2%. This showed that 1% free ammonia at the wellhead could be taken as a yardstick for future treatments. Since the alkalinity suppresses H^+ ion concentration and reduces corrosion, we believed that wells which had been treated several times could be protected in the upper 2,000 ft. by maintaining at least 1% free ammonia at the wellhead. Because of this, and for economic and practical reasons, all the wells which tested over 1% free ammonia on the last test are now being treated every 6 months with 25 lb. and those having less than 1% free ammonia with 50 lb. every 6 months. The amount of ammonia injected has been increased in these latter wells to compensate for a faster decline of free ammonia.

Distribution of free ammonia. After establishing the frequency of injection which would maintain sufficient

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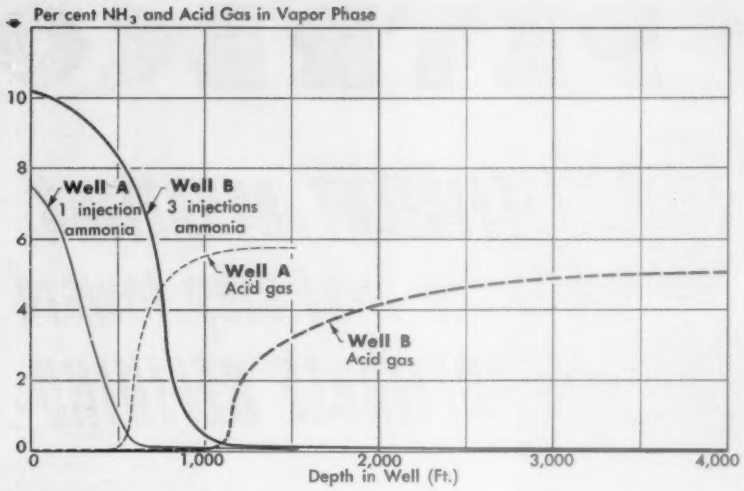


DISTRIBUTION OF GASES—ammonia and acid gases—in vapor phase from blowdown tests. Fig. 3.

ammonia at the wellhead between injections, we decided to conduct tests to obtain information about the distribution of the ammonia in the annular space for wells injected several times. Blowdown tests were conducted on five wells in Wasson field in August 1958.

Total amount of ammonia which had been injected into the wells selected for the tests varied from 75 to 125 lb. The casing-head pressures ranged from 600 to 1,300 psi. Blowdown tests consisted of bleeding off gas from the annular space to the atmosphere at a controlled and continuous rate, and periodically measuring the free ammonia and acid gas content. These tests established the concentrations of ammonia and of acid gases for various depths, Table 1 and Fig. 3, Well B. These tests show that ammonia had penetrated in four wells to a depth of over 4,000 ft. In the fifth well the ammonia had penetrated to only 1,500 ft. This well had lost free ammonia due to a leak in the casing wing valve.

Fig. 3 shows that the free ammonia concentration is fairly high at the surface and then declines rapidly with depth. Acid-gas content is negligible where the ammonia concentration is greater than 0.2%. Below this value the acid-gas content builds up rapidly and soon reaches the amount equal to the original value measured prior to ammonia injection. Ammonia content continues to decline with depth and eventually becomes immeasurable.

Results of these tests compare favorably with data from blowdown tests conducted in 1954 during the experimental stage of this program. Data from one of these early tests are shown in Table 2 and also in Fig. 3. Comparison of new tests with earlier tests shows that the free ammonia penetrated to a greater depth in wells which had been treated several times. In addition, the depth at which the maximum acid-gas concentration appears has been shifted further downhole in these wells. The higher concentration and deeper penetration of ammonia in the wells which were injected several times show that continued injection of anhydrous ammonia will result in free ammonia existing throughout the annular space. Continuous ammonia injection will also reduce the acid gases to negligible amounts.

How it works. By maintaining alkalinity in condensed water, corrosion due to acid gases should be reduced. Therefore, alkalinity was selected as the criterion for protection. From the partial pressures of NH_3 and CO_2 in the gas phase, we can determine whether or not the solutions on the casing wall are alkaline. From blowdown data the partial pressures of NH_3 and CO_2 can be found for any depth in a well.

The compositions and vapor pressures of aqueous solutions of NH_3, CO_2, and H_2S were found by Van Krevelen et al.[8] Compounds formed by the reaction of NH_3 and H_2S in solution exert negligible vapor pressures; therefore, they are not included in the discussion.[9]

Van Krevelen et al. presented the interrelation of partial pressures and compositions of solutions containing NH_3 and CO_2 in two diagrams. Typical examples of these are shown in Fig. 4. In the first diagram (A) the vapor pressures of NH_3 and CO_2 at 40° C. are plotted as a function of the ratio (R) which is total CO_2 to total NH_3 in solution. Several solutions of different normalities of total ammonia are given. The term "total" includes both free and combined forms of each gas.

In diagram B the aqueous components formed by NH_3 and CO_2 are given as a function of R for a 2N solution of NH_3 at 20° C. The upper part of this diagram represents only combined CO_2, the lower part represents NH_3 in free form as well as in combined form. The concentrations of all components are expressed as mole fractions of total NH_3.

Using the diagrams of Van Krevelen in conjunction with blowdown data for Well B, we can show that any condensed water on the casing wall from the surface to 4,000 ft. is alkaline. The composition of our solutions cannot be determined exactly from these two diagrams, because temperatures and concentrations of total ammonia are different. The diagrams change slightly with concentration of total NH_3 and with temperature. Relative amounts of the various components in solution can be estimated from the two diagrams, Fig. 4.

At the surface the partial pressure of NH_3 is 4,780 mm. Hg and that of CO_2 is negligible. Temperature is approximately 22° C. Diagram A shows that for these partial pressures the ratio (R) of CO_2 to NH_3 in solution is practically zero. From Diagram B, we note that when R is nearly zero the solution consists primarily of free ammonia and some ammonium (NH_4^+) and carbamate (NH_2COO^-) ions. Bicarbonate (HCO_3^-) and carbonate (CO_3^{--}) ions are practically nonexistent. Since the solution at this point contains mostly free NH_3, it is highly alkaline (pH over 12).

At 1,100 ft. the partial pressures of NH_3 and CO_2 are equal ($P_{ammonia} = P_{carbon\ dioxide} = 95$ mm. Hg). Temperature at this depth is 30° C. At these conditions the ratio (R) is estimated to be 0.6 and total NH_3 is about 5.0 g. moles/l. The solution contains primarily ammonium, carbamate, and bicarbonate ions. Free ammonia concentration is low and carbonate ions are negligible. This solution is also alkaline (pH approximately 10).

At 4,000 ft. the partial pressure of CO_2 is 2,330 mm. Hg and that of NH_3 is 14 mm. Hg. The temperature is approximately 40° C. The ratio (R) is about 0.8 and total NH_3 is 4.5 g. moles/l. NH_3 is still in excess of CO_2 in the condensed water on the casing wall. The solution contains primarily ammonium and bicarbonate ions and some carbamate ions. The solution is still alkaline (pH approximately 8).

Besides the reactions in the solutions on the casing wall there are also reactions occurring in the gas phase. The primary products formed between ammonia and acid gases in the gas

phase are ammonium carbamate and ammonium hydrogen sulfide. These salts do not require any water for their formation. The reactions between $NH_{3(g)}$ and $CO_{2(g)}$ and $H_2S_{(g)}$ depend only on the amount of reactants present. Since the amount of $CO_{2(g)}$ (5.0%) is large in comparison with $H_2S_{(g)}$ (0.1%) the primary product formed is ammonium carbamate.

Ammonium carbamate unites readily with water vapor to form ammonium carbonate:

$$NH_4COONH_{2(s)} + H_2O_{(g)} \rightleftarrows (NH_4)_2\ CO_{3(s)}$$

The amount of products formed by the vapor-phase reactions is greatest in the upper part of the casing-tubing annulus where ammonia is in excess of carbon dioxide. In the lower part of the casing the reactions are limited by the decreasing availability of ammonia.

The gaseous reactions tend to stifle corrosion by tying up carbon dioxide, hydrogen sulfide, and water vapor in the form of noncorrosive salts. By shifting the gaseous reactions down the hole with successive injections, Fig. 3, it is possible to obtain a noncorrosive system throughout the annulus.

Effectiveness of ammonia. The benefits of NH_3 in controlling internal casing corrosion can best be shown by the lack of casing leaks in two fields where ammonia injection has been maintained since 1956. These two fields, Wasson and Seminole, were the most severely affected by internal casing corrosion.

Prior to treatment, we had a total of 13 casing leaks in Wasson field and 6 in Seminole field. Based on this frequency, we should have had as many as 12 leaks since 1956; however, no leaks have occurred.

Another operator in Wasson field has been treating two wells with anhydrous ammonia since 1952. Caliper surveys have shown ammonia to be effective in the control of internal casing corrosion.

TABLE 1—BLOWDOWN OF WELL B

Depth, ft.	% NH_3	% Acid Gas
0	10.2	....
158	9.9	....
306	9.5	....
456	8.6	....
618	7.1	....
942	2.9	....
1,152	0.14	1.6
1,560	0.10	3.4
2,370	0.09	4.5
2,920	0.08	4.9
3,140	0.07	4.8
3,537	0.05	4.95
3,980	0.03	5.0

Casing pressure = 910 psia.

Injection dates:	Amount
Nov. 1956	25 lb.
Mar. 1957	25 lb.
Feb. 1958	50 lb.
Total injected	100 lb.
Date of blowdown	August, 1958

TABLE 2—BLOWDOWN OF WELL A

Depth, ft.	% NH_3	% Acid Gas
0	7.5	....
100	7.1	....
210	5.0	....
385	2.5	....
585	0.8	2.5
785	0.07	4.9
1,000	0.05	5.6
1,275	0.04	5.8
1,550	0.037	5.8

Casing pressure = 530 psia.

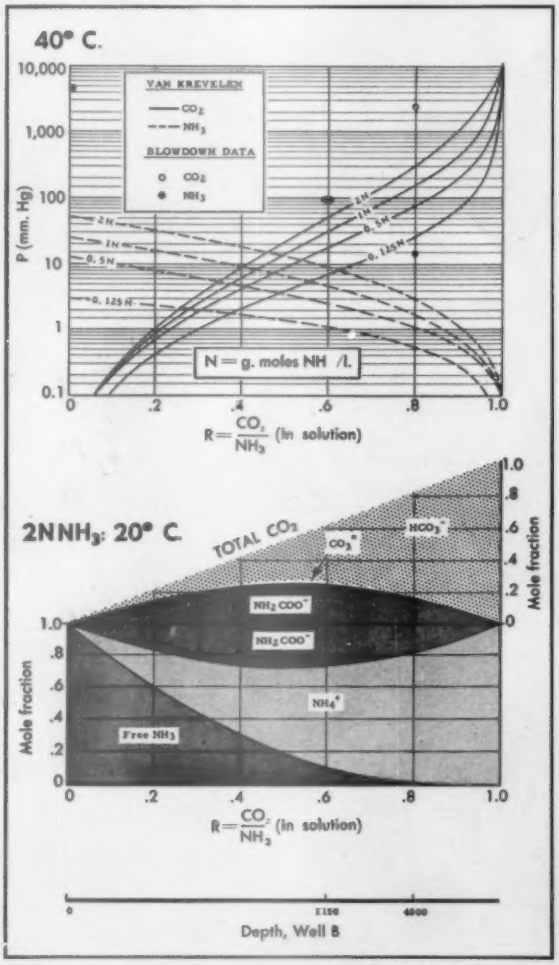
Injection date	Amount
June 1954	28 lb.

Date of blowdown .....Sept. 1954

Other operators with no corrosion-control programs for their unpacked flowing oil wells in these fields have continued to have occasional internal casing leaks.

Economics. The average cost of this program is less than $50 per well per year based on our present treating schedule of one injection each 6 months. The cost includes amortization of injection equipment, and expenditures for labor, food, lodging, gasoline, oil, maintenance, ammonia, and glycol. At the present we are averaging 200 injections per year at a total cost of less than $5,000.

In contrast to this, the cost of installing packers in the wells which are on the ammonia injection program would have averaged close to $1,500 each or a total of $150,000. This does not include the cost of removing the packers after wells go on artificial lift or the cost of maintaining an oil-filled annulus. Inhibited-oil wash treatment for the wells on our ammonia program would average close to $110 per well per year. This is more than double the cost of ammonia injection.



PARTIAL pressures and compositions of solutions containing NH_3 and CO_2 are interrelated. Fig. 4.

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New high-gel cement makes casing jobs cheaper, surer

BY ED McGHEE
Drilling Editor

A NEW cement mixture which carries a high content of gel (bentonite) and still retains sufficient strength for common oil field use has been formulated by Gulf Oil Corp.

As a result of the added gel, the cement slurry has low water loss, is lightweight, and is cheaper than any other composition now used to cement oil-well casing.

The company now cements oil-well casing with slurries containing as much as 16 to 20% of gel by weight (compared to dry-cement weight). In ordinary cement, such a great proportion of gel would cut strength too low to be practical. In the Gulf-devised mix, 24-hour compressive strength is above the 500-psi. mark considered by many to be the workable minimum.

Water loss of the high-gel slurries ranges around 120 cc. per 30 minutes. This figure is somewhat deceptive. Reason is that the slurry contains so much water—as much as 140% by weight compared to dry cement. As a result, the filter cake built up by the high-gel cement is much thinner than the cake built up by a neat cement showing a water loss only one-half as high.

In the well, the low water loss and thin filter cake pay off. There is little buildup of cement particles on the face of permeable formations. Thus, there is no artificial restriction to choke down circulation and build up pumping pressures.

With high-water-loss and thick-filter-cake cements, the buildup in pressure frequently results in breakdown of weak formations. Then, the cement does not rise high enough around the casing.

Chances of getting a good casing-cement job are further improved by the light weight of the high-gel slurry. Mixtures have been as light as 12.1 lb. per gal. Thus, the hydrostatic head of a column of this cement is not high enough to rupture more than the very weakest formations.

Water is cheap. "The cheapest cement additive we know is water," says a Gulf man. "And, the more gel we're able to use, the more water we use." After water, the gel itself is probably the next cheapest additive. So, a slurry with lots of water and lots of gel is far cheaper than older cement compositions which include special materials to reduce water loss and density.

Salt and dispersant. Secret of the high-gel cement is using a small, but critical, concentration of sodium chloride—ordinary salt. Or, calcium chloride may be used instead. In addition, a dispersant is necessary.

Gulf has not discussed any unique action that the salt may have on the chemistry of the high-gel-cement blend. It is common knowledge, however, that 1 to 4% of salt raises the compressive strength of neat cement by as much as 50% at certain conditions. Calcium chloride raises neat-cement strength even more.

Gulf uses a concentration of ½ to 5% salt, with the ideal being around 3%. The salt can be added by dry mixing with the cement itself.

Function of the dispersant, Gulf men say, is not so critical as that of the salt. Several common dispersants, including calcium lignosulfonate, may be used.

Company tests show that the new cement blend is not easily harmed by many usual cement contaminants. Gypsum is not especially harmful. Sea water can easily be used in mixing the slurry.

According to Gulf, there is no sacrifice in pumpability, thickening time, or setting time.

Gulf has applied for patents on its new cement in a number of countries. So far, no service company has been licensed to use the mixture.

In the field. The high-gel cement is now in common use on Gulf wells. It has been particularly successful in the problem areas of Mississippi and West Texas.

In a typical Mississippi job, the mix was used to cement 7-in. casing to 10,998 ft. in Gulf's 1 Thornton 36-12 in Heidelberg field near Laurel. The Heidelberg formation itself is a problem because of its high porosity. Older cements tended to build up a thick filter cake on the face of the zone.

With the new high-gel cement, cake buildup is thin and cement is easily displaced, usually rising to the calculated height.

In West Texas, the cement was used on the company's A-14-D Jerusha Robbins in Puckett Devonian field. A slurry weighing about 12.6 lb. per gal. and containing 16% gel was used to cement pipe run to 10,340 ft. On this job, cement top rose to 1,945 ft.; it could have been circulated to the surface if sufficient cement had been mixed.

In other Puckett area wells, there was a persistent problem getting good cement fillup. Result was that expensive water-loss-control materials and costly density reducers had been used. Now, the high-gel cement performs equally well but costs only a fraction as much.

HIGH-GEL CEMENT is used to cement 10,998 ft. of 7-in. casing in Gulf Oil's 1 Thornton 36-12 in the Heidelberg field near Laurel, Miss. Older cements had problems with cake buildup on porous formations; 5 M.c.f. of the high-gel slurry were displaced on this job without trouble.

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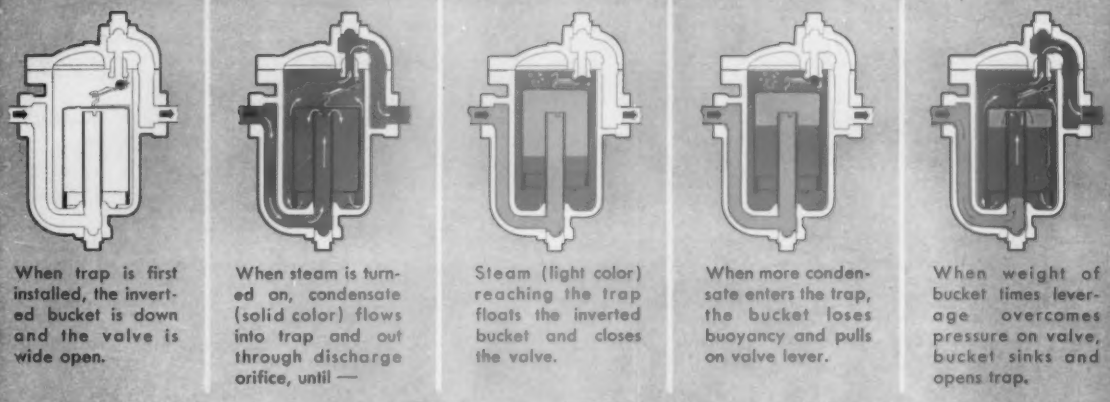

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Key: condensate steam steam bubbles air bubbles

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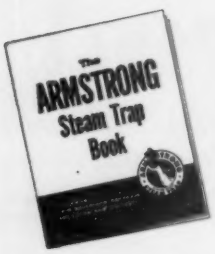

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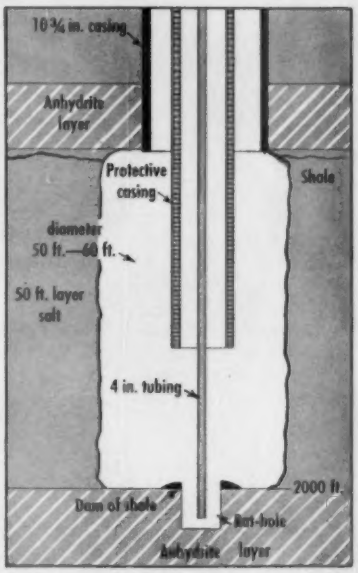
Underground ammonia storage has disadvantages

BY HUGH S. PYLANT
Petrochemical & Gas-Processing Editor

SIX YEARS of operating an underground ammonia-storage cavity has convinced Phillips Chemical Co. that the advantages of this type of ammonia storage are more than offset by the many problems and extra expenses that were encountered.

Phillips needed additional ammonia storage at the Cactus plant in West Texas. Since they had experience in salt-cavern storage of LPG in this area and found it practical, it was logical to consider this type of storage for ammonia.

Propane and ammonia have approximately the same vapor pressure, and storage vessels and tank cars are used interchangeably for these products. So after conducting tests in the lab, such as the solubility of salt in ammonia, corrosive effects on various materials, etc., the project of storing ammonia underground was undertaken.



UNDERGROUND salt cavity is being used for ammonia storage.

Construction. First it was necessary to find the right formation for a storage cavern. Phillips had to be certain that the ammonia wouldn't leak out to contaminate underground water. Test cores were drilled and fortunately a good location with a 50-ft. salt layer between two layers of anhydrite was found adjacent to the Cactus plant. The cavity was washed out, using the same procedure as in forming LPG storage, to a diameter of 50 to 60 ft. This provided an additional 35,000 to 40,000 bbl. of ammonia storage 2,000 ft. below ground.

On completion of the washing operation, shale, apparently from underneath the top anhydrite layer, sloughed off and filled up the rat hole which had been drilled to insure complete removal of the stored ammonia (see diagram). This hole had to be drilled out again to remove the shale.

The cavern had to be completely dry before ammonia could be injected, so waste gas from the ammonia plant, consisting mostly of hydrogen and nitrogen, was used to displace brine left from the washing operation. This purge gas off the synthesis converter was available at 5,000 psi.

Operation. The first injection of 1,100 tons of ammonia was made in January 1954. When the first withdrawal was made in March of that year, it was surprisingly found that the cavity hadn't been completely dry and the effluent was a salty aqua solution containing about 60% ammonia. Lab tests had indicated that anhydrous ammonia should not dissolve any more than 5% salt and even less than this was actually expected.

When it was found that all of the contaminated ammonia couldn't be removed, it was obvious that a "heel," or small reservoir that couldn't be drained, was present in the cavity. It seemed reasonable to believe that the shale which had fallen in and filled up the rat hole, had also formed a dam around the hole.

The cavity has been subsequently filled three or four times in the off seasons with 3,000 or 4,000 tons of ammonia, and each time it was withdrawn, the recovery was higher. Last season, the product was 90 to 95% ammonia. This indicates that liquid remaining in the heel is becoming pure ammonia and eventually no significant contamination will take place.

Purification. The contaminated ammonia must be purified before sale since the limit of salt content for agricultural use is about 1,000 p.p.m. Fortunately no reaction products, such as ammonium chloride, are formed and there is only the solubility problem. This purification is still difficult, though, because of the high concentration of solids. Total dissolved solids in the initial withdrawal of ammonia ran 19-20%, and it still is about 6%. To date, a total of 13,000 tons of ammonia has been withdrawn from the storage cavity and 800 tons of salt have come out with it.

In the purification process, ammonia is converted into a 25 to 40% aqua solution, run through settling tanks, an antifoam agent is added, and it is then distilled in a packed column. (No excessive corrosion has been encountered.) The biggest problem has been carryover due to foaming with the exact cause of this foaming still undetermined.

Disadvantages. The cavity itself would be a very attractive investment at a cost of $1.50 to $2.00 per barrel of storage capacity, compared to $10.00 per barrel of refrigerated pressure storage and $2.00 per barrel of 30% aqua storage, but the disadvantages listed below tend to offset this cost advantage.

1. It is very difficult to create a suitable cavity as can be seen from the shale and heel problem that Phillips encountered.

2. The energy required for removing the ammonia is a problem. A bottom-hole pump, such as used in other storage wells, couldn't be used here because of the adverse effects of the ammonia on the electrical cable insulation.

It would be very expensive to install compressors to obtain sufficient pressure for the job, and high-pressure natural gas would be pretty expensive. Therefore, location of underground storage wells for ammonia is pretty well limited to places where a high pressure waste gas is available.

3. The inability to get a reasonable recovery of an expensive product must be considered.

4. The necessity of purifying the product before use adds to the cost of the ammonia.

5. At the end of the ammonia season, the cavity is pressurized with gas that contains quite a bit of ammonia vapors so it must be depressured through an ammonia vapor-recovery system. If a vapor-recovery system is not existing at the storage site, it must be built at additional expense.

This cavity represents only a small portion of Phillips' total storage at the Cactus plant and is considered experimental. Based on the results of this project, no more underground storage for ammonia is planned for the near future, and more aboveground, aqua and refrigerated, storage has been added since.

Shell's 14,000 ft.

New Gulf Coast record set in

of open hole

BY ED McGHEE
Drilling Editor

AT WEEKS ISLAND, Louisiana, Shell Oil Co. has drilled a well from 3,005 to 17,000 ft. without setting an intermediate string of pipe.

The resulting 13,995 ft. of open hole is the longest ever carried on the Gulf Coast. In spite of the lengthy stretch of exposed formations, the well was completed speedily and without trouble.

Over-all drilling time from spud to total depth was a mere 51 days. Only 48 of these were consumed in cutting the 13,995 ft. of 9⅞-in. open hole. Shell's 2 W. G. Weeks et al. ranks among the world's deepest producers; but because no intermediate string of pipe was run and because the well was completed quickly, total cost was no more than is common in many areas for holes only half as deep.

There are four basic reasons for Shell's success on the hole. These are: (1) long experience at Weeks Island, (2) a carefully planned drilling program, (3) a surface location picked to offset natural hole drift, and (4) favorable downhole conditions. Of course, the list isn't complete without adding willingness to take a calculated risk when the odds are good enough for the saving possible!

Enviable achievement. Drilling 14,000 ft. of open hole is an enviable achievement even in the hard rocks of the Permian basin or the Rocky Mountains. It is doubly admirable in the soft sediments of the Gulf Coast. It's uncertain just what the old record for uncased hole in the area might have been. Old hands in South Louisiana say the Shell well had 2,000 to 3,000 ft. more open hole than any other they've known.

For the nation as a whole—and the remainder of the world—the open-hole record is 16,002 ft. Figures of The Oil and Gas Journal credit that amount to a Phillips Petroleum Co. well in Sublette County, Wyoming, where formations are harder and more stable than on the Gulf Coast.

The situation. Several factors favored a long stretch of open hole in the 2 W. G. Weeks. Formation pressures in the area are normal and no heavily weighted mud is needed. Generally, the formations themselves are more stable than in a number of other nearby oil areas.

Moreover, Shell crews at Weeks Island have accumulated a lot of know-how on superdeep drilling. These men consider 17,000-ft. wells "routine." On and off for the past decade, various of the company's wells in the field have held title as world's deepest producer.

There are problems, however. As on most salt domes, wells on Weeks Island tend to go off vertical in the steeply dipping beds on the dome's flank. Often, this tendency means that weight on bit must be kept light to keep the hole straight. Instead of accepting the light weight and slow drilling, Shell chose a different course. The surface location was picked so that an off-vertical hole was satisfactory. From experience, the company could predict the direction the hole would slant. Then, the surface location was spotted so that the well naturally aimed for the proper bottom-hole target.

Drilling was done by Shell's Marine Rig No. 7, an island barge steam unit. This rig carries five 150-hp., 350-psi. boilers and an Emsco J-200 draw works driven by an Ajax 16-by-16 engine. Pumping power is provided by two National 19 by 7¾ by 22-in. pumps. The rotary is independently powered by a 12-by-12 steam engine.

The 189-ft. derrick handles fourbles.

The drilling program. On many of its Gulf Coast wells, Shell now uses a technical approach in picking the best bit weights and rotary speeds to be used. Basis of the method is a collection of charts which relate drilling speed with bit weight, bit life, rotary speed, and hydraulics. These charts were developed by John W. Speer, formerly Shell's area drilling engineer at New Orleans, and they are presented by The Oil and Gas Journal in a two-part article published March 31 and April 7, 1958.

The chart-selected weights and speeds were used on the 2 W. G. Weeks et al. Table 1 outlines these weights and speeds as well as the hydraulic program and drill string. The weights are high but not unusually so for the area. However, rotary speed (175 r.p.m. below 15,000 ft.) is higher than is common in almost all areas.

Notice also that pump pressures were kept high (2,200 psi.) and that circulation rate was as great as 500 g.p.m. below 15,000 ft. These practices combined to make possible the 13,955 ft. of 9⅞-in. hole drilled in only 48 days.

The drilling mud. Part of the drilling speed results from the fact that weight was never heavy enough to seriously impede cutting action of the bit. Although many nearby fields commonly use 18-lb. per gal. mud, that in the 2 W. G. Weeks never went over 11.8 lb. per gal.

Down to 14,600 ft., the mud was a low-pH red mud, the fluid Shell has customarily used at Weeks Island. At this depth, however, mud coming off bottom after trips was quite viscous—

TABLE 1—DRILLING PROGRAM ON SHELL OIL CO.'S 2 W. G. WEEKS ET AL.

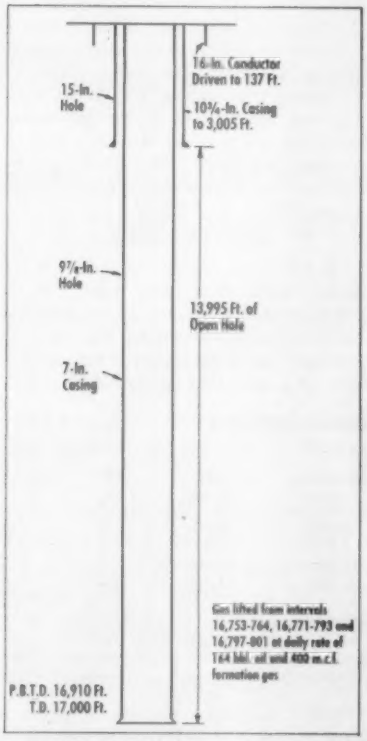
	3,005 to 10,000 ft.	10,000 to 15,000 ft.	15,000 to 17,000 ft.
Weight on bit, 1,000 lb.	25 to 40	40	25
Rotary speed, r.p.m.	200 to 250	150 to 200	175
Drill collars, number, size	Twelve 8-in.	Twelve 8-in.	Twelve 7-in.
Stabilizers, number, type	Four full-gage	Four full-gage	Four full-gage
Drill pipe, size	5-in. X-hole	4½, 5-in. X-hole	4½, 5-in. X-hole
Bit nozzles, number, size	Three ½-in.	Three ½-in.	Three ½-in.
Pump pressure, psi.	2,200	2,200	2,200
Mud type	Low pH	Low-pH oil emulsion	Low-pH oil emulsion
Mud weight, lb. per gal.	9.5	9½ to 11½	11½

Editor's note . .

As Journal editors talked with Shell Oil Co. men about the long open hole in the company's 2 W. G. Weeks, it developed that a new treatment material had been used in the mud on that hole. We found the material interesting and asked the supplier to tell us more about it. Jung's article here is the reply.

as high as 300 seconds per quart. To thin the fluid, 3 lb. per bbl. of a new, modified lignosulfonate was added to the system. After this the fluid coming off bottom after trips was never higher than 67 seconds in viscosity. In the tanks, viscosity fell from 75 seconds to 42 seconds and water loss dropped from 4.5 to 3.2 seconds.

Treatments with the new material continued to total depth. There was no further mud trouble and the mud cost held at a low level.


16-In. Conductor Driven to 137 Ft.
15-In. Hole
10¾-In. Casing to 3,005 Ft.
9⅞-In. Hole
13,995 Ft. of Open Hole
7-In. Casing
Gas lifted from intervals 16,753-764, 16,771-793 and 16,797-801 at daily rate of 164 bbl. oil and 400 m.c.f. formation gas
P.B.T.D. 16,910 Ft.
T.D. 17,000 Ft.

LONGEST SECTION of uncased hole ever drilled on Gulf Coast was this 13,995 ft. in Shell Oil Co.'s No. 2 W. G. Weeks.

New mud organic—

A different approach to reducing drilling costs

BY R. A. JUNG
Director of Technical Services
Milwhite Mud Sales Co., Houston

AFTER 2 YEARS of laboratory search, our research department has developed and perfected a promising new mud-treating material. This material is a heavy-metal lignosulfonate complex never before synthesized.

It has now been used on more than 40 drilling operations. From these field results and laboratory tests, the material has proved it can:

1. Thoroughly deflocculate mud so that flow properties are most desirable as a drilling fluid.

2. Improve the inhibiting effects to prevent degradation of clay particles—this requires less water dilution.

3. Effectively control downhole fluid loss without impairing flow properties.

4. Eliminate the necessity of a dangerous and expensive "conversion" or "breakover."

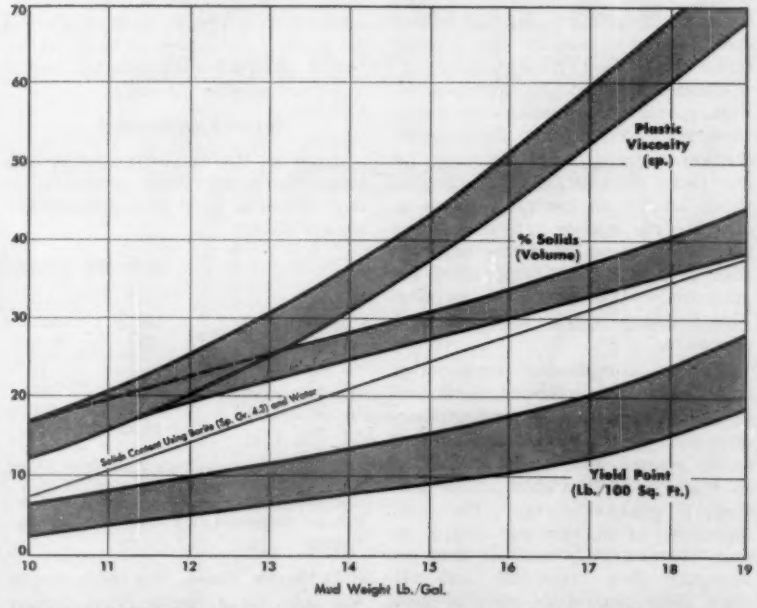
5. Extend the limits of contaminant tolerance beyond those of present mud systems.

6. Increase stability at high temperature.

7. Eliminate the necessity of creating a specified environment for the purpose of improving the efficiency of the deflocculant.

The problem. The prime contaminant in drilling mud, whether from standpoint of making hole or of producing a well, is the formation clay solids. More money is spent on the Gulf Coast to combat this contamination than for any other contaminating agent, such as high-pressure gas, salt-water flows, and lost circulation.

Amount of swelling of a given clay, such as bentonite, can be controlled by chemically altering the aqueous phase. This can be done by adding sodium chloride, calcium chloride, calcium sulfate, or almost any elec-



OPTIMUM RANGES for control of viscometric properties of a Uni-Cal mud system. Use of sufficient quantities of the new organic keeps mud properties within these bands which represent near-ideal flow characteristics.

trolyte. The greater the concentration of the electrolyte in the water phase, the less bentonitic-type clays swell.

In field practice, hydration and clay-swelling control can be measured quantitatively by the amount of weighting material used to drill a high-pressure well. If these factors are not controlled, dilution is necessary to maintain a proper level of solids. It is necessary to build the weight of each barrel of water added to a mud system. This becomes very expensive, particularly when high mud weights are required.

A basic function of any drilling mud is to protect the well bore. The terms "well-bore protection" and "fluid-loss control" are considered synonymous. The fundamental idea of fluid-loss control is that intruding filtrate from the drilling mud into well formations is harmful.

There are standard tests which aid in determining how much filtrate is penetrating the formations. While these tests are a step in the right direction, they are run under surface conditions. The water loss is checked by exposing a mud sample to 100 psi. and surface temperature. This temperature ranges from about 75° to 120° F.

Many fluid-loss-reduction agents are very effective under these conditions but fail under downhole conditions. When temperature and pressure—especially temperature—increase, these materials lose their effectiveness. In extreme cases they disintegrate completely. As drilling goes deeper, higher temperatures and pressures are found; this fact aggravates the problem caused by the conventional fluid-loss materials.

Controlling fluid loss decreases the wetting rate of formation-clay solids. However, conventional fluid-loss-reduction materials yield viscosity. We are faced with a paradox: on one hand, we try to lower fluid loss to decrease the wetting rate of cuttings for the purpose of controlling viscosity. And, at the same time, the materials we are using yield viscosity. This situation is both inefficient and expensive.

Various complicated versions of these electrolytic-inhibited mud systems have been used. In each instance, however, specific environments had to be created and rigidly controlled so that the deflocculant could perform at peak efficiency. The cost, therefore, of maintaining control of such characteristics as fluid loss, gel strengths, flow properties, and pH place these electrolytic-inhibited mud systems in the category of being too expensive.

Reducing additives. The accepted approach in the past toward drilling-mud control required the use of innumerable different chemicals. Each one contributed toward a change in the individual characteristics, such as flow properties, fluid-loss control, and pH. Regardless of the system or chemicals, the drilling department faced the constant decision of sacrificing some desirable characteristics which protect the well bore. It was necessary to increase penetration rates to save time and money.

This approach inevitably placed drilling mud in the category of an "expensive expense" rather than a wise investment from which a profitable return could be expected.

Often, when penetration rates have been increased at the expense of good mud properties, high formation pressures have caused trouble. The well bore might become unstable, or the mud's flow properties might deteriorate still further. These conditions force the operator to make drastic and expensive changes in the mud.

After analyzing the indaequacies of drilling-mud systems past and present, our research department began a program to develop a system which would incorporate all of the advantages of conventional mud systems and, in addition, include many advantages not in the field today.

Development and perfection of the material Uni-Cal was the result. More than 2 years of laboratory research were spent before it was ready for field evaluation. It has been used on more than 40 drilling operations, all of which were classed as experimental. These drilling operations were chosen to perfect techniques as well as to obtain maximum information on a minimum number of wells.

Fluid-Loss Control

Some of the fluid loss results obtained on experimental operations in two different Gulf Coast areas are shown below:

INSHORE BARGE, SOUTH LOUISIANA

Number of drilling days	Depth (ft.)	API funnel viscosity seconds	Calcium p.p.m.	Salt p.p.m.	Oil %	Fluid loss ml.
*1	7,100	34	1,480	¶30,000	0	35.0
†2	7,780	35	900	24,000	0	18.5
‡3	8,800	35	200	14,400	2.0	8.5
§6	11,200	44	320	11,200	9.0	3.9

*Native untreated sea-water mud. †Mud after addition of 2 lb. per bbl. Uni-Cal. ‡Mud after Uni-Cal concentration brought to 5 lb. per bbl. plus 2% diesel-oil emulsion. §Oil concentration increased to 9%. Uni-Cal concentration brought to 6 lb. per bbl. ¶As drilling progressed, salt concentration was diluted with fresh water to improve electric logging.

In South Texas. The new system was used on a South Texas drilling operation in which temperatures up to 300° F. plus were expected. Periodically during this operation high-temperature fluid-loss characteristics were tested with the following results:

Weight, lb. per bbl.	17.9
Apparent viscosity, cp.	53
Plastic viscosity, cp.	46
Yield point, lb. per 100 sq. ft.	15
Initial gel, lb. per 100 sq. ft.	0
10-min. gel, lb. per 100 sq. ft.	7
Ca^{++}, p.p.m.	320
Pf, ml.	0.3
Cl^{-}, p.p.m.	3,200
pH	9.7
API filtrate, ml.	2.4
High-temperature filtrate, ml. (500 psi. at 300° F.)	7.4

Contamination Resistance

A well was being drilled in offshore Louisiana using a Uni Cal fresh-water mud system. (See Column 1 below). It encountered a high-pressure salt-water flow. The crews started the "degasser" to mechanically remove the gas from the mud system. Barite was added to increase mud weight to between 16.3 and 16.8 lb. per gal. Gas and salt water continued flowing into the mud system and cut the mud weight to 15.5 lb. per gal. Surface volume increased approximately 150 bbl.

A mud check showed the chlorides had increased to 15,000 p.p.m. and calcium to 400 p.p.m. During the night, there were a series of mechanical breakdowns which slowed their barite additions. In the morning mud properties were as shown in Column 2. When the well was brought under control the mud had the flow properties as shown in Column 3.

During this interim 200 lb. of Uni-Cal was used. Due to the salt-water intrusion the mud system was diluted a total of 33⅓%. The fluid loss increased as a result of this dilution from 2.0 ml. to 5.8 ml.

High Temperature

A hole was drilled at 12,000 ft. in South Texas. The fresh water system being used did well until high bottom-hole temperature caused the mud to gel up after trips. Adding 1.5 lb. per bbl. of a standard deflocculant didn't help. There was no improvement when 10% by volume of water was added.

Then 2 lb. per bbl. of Uni-Cal was added.

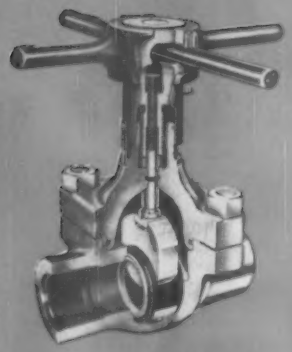


Figure 2126 Resilient Seat Gate Valve. 2", 3", 4", 2000 lb W.P. EValcoat protective Plastic Coating.

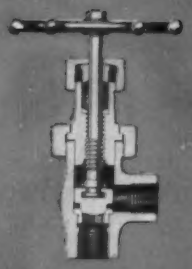


Figure 2699 Forged Steel Angle Valve. ½", ¾", 1", 2000 lbWOG. Not Plastic Coated.

Figure 152J Forged Steel Gage Valve. Size ½", 4000 lb WOG. Not Plastic Coated.

Figure [illegible] Throttle Disk Forged Steel Globe Valve. Size 1", [illegible]000 lb WOG. EValcoat Plastic Coating.

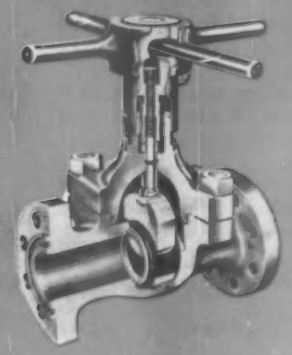


Figure 3116 Resilient Seat Gate Valve. 2", 3", 4", 2160 lb W.P. EValcoat protective Plastic Coating.

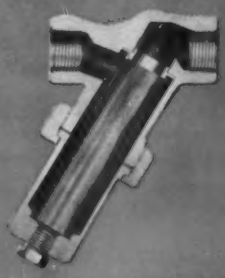


Figure 126 Forged Steel Strainer. Size 1", 2000 lb WOG. EValcoat protective Plastic Coating.

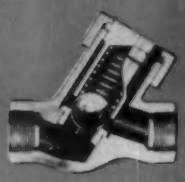


Figure 2676 Forged Steel Check Valve. Size 1", 2000 lb WOG. EValcoat protective Plastic Coating.

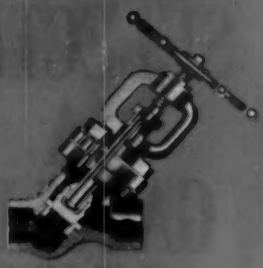


Figure 448 Forged Steel Globe Valve. 1½", 2", 2000 lb WOG. Not Plastic Coated.

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	Column 1	Column 2	Column 3
Weight, p.p.g.	16.3	15.8	17.1
API funnel viscosity, seconds	53	45	75
Apparent viscosity, cp.	51	33	75
Plastic viscosity, cp.	45	30	54
Yield point, lb. per 100 sq. ft.	15	10	18
Gels, lb. per 100 sq. ft.	0-3	0-6	0-6
Ca^{++}, p.p.m.	80	800	800
Pf, ml.	.5	0	0.5
Cl^-, p.p.m.	5,500	29,000	44,000
pH	9.5	8.0	9.5
Solids by volume, %	31	.....	37
Oil by volume, %	3	.....	2.5
API filtrate, ml.	2.0	4.0	5.8

After the first circulation, funnel viscosity dropped from an almost immeasureably high value to 55 seconds. After the second circulation, gels were quite low and other properties were excellent. Water loss came down and mud stability improved.

The well was drilled to 13,500 ft. and mud properties were easily maintained with hourly additions of the material.

Complete System

A Louisiana operator drilled four development wells. The well in which the new system was used demonstrates the effectiveness of a complete drilling fluid:

	Uni-Cal well	Well 1	Well 2	Well 3
Depth (ft.)	13,304	13,294	13,295	13,288
Number of bits used	30	33	36	38
Rotating hours	390.5	431	602.6	467.5
Total days	33	36	43	41

Type mud:

Uni-Cal well—8% oil emulsion.

Well 1 — Gyp-dispersed, 8% oil emulsion plus EP lubricant.

Well 2 — Gyp-dispersed, 8% oil emulsion.

Well 3 — Gyp-dispersed, 8% oil emulsion plus detergent.

Summary:

1. Uni-Cal well drilled to 13,500 ft. in four additional days with no trouble. Total mud cost $18,378.56.
2. Well 1 stuck pipe at 13,294 ft. for 24 days. Total mud cost $29,214.00.
3. Well 2 drilled to 13,519 ft. in 10 additional days. Total mud cost $27,247.55.
4. Well 3 drilled to 13,506 ft. in 6 additional days. Total mud cost $29,326.27.

Hydration control. A development well drilled in offshore Louisiana using the Uni-Cal system clearly illustrates the effectiveness of Uni-Cal as a hydration and clay-swelling control agent. This well is compared with the average of three offset wells drilled by the same contractor and operator. The offset wells were drilled using a dispersed gypsum system.

	Uni-Cal Well	Average of 3 Offset Wells
Total depth (ft.)	14,672	14,670
Protection casing depth (ft.)	12,700	12,800
Maximum mud weight, p.p.g.	18.0	18.0
Cost of weight material	$30,390.95	$50,723.50
Total bits used	38	51
Days drilling time	48	59

Summary:

1. Savings on weight material	$20,332.55
2. Savings on 13 bits at $245.00 each	3,185.00
3. Savings on 11 days rig time at $6,000.00 per day	66,000.00
Savings over average of three offset wells	$89,517.55

Coming:

Europe's Booming Oil Industry

NEXT WEEK, the Journal will feature a special 50-page report on the big happenings in the oil and gas industry in Europe and North Africa.

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28. How to find interstitial-water saturation

. . . in a clean sand from electric and contact log data

BY E. T. GUERRERO
and
F. M. STEWART

GIVEN: Electric and contact logs showing the Gibson sand (Fig. 1) for a well in Oklahoma. Resistivity of interstitial water = R_w = 0.088 (measured on samples of formation water at formation temperature = 115° F. Residual-oil saturation in flushed zone = ROS = 20.0% of pore space. All other data shown on the logs.

FIND: Interstitial-water saturation in the interval 203-223 ft.

METHOD OF SOLUTION: Relationships needed in the solution of this problem are:

$$F = R_o/R_w \quad (1)$$

$$S_w = (R_o/R_t)^{1/2}$$

$$= (FR_w/R_t)^{1/2} \quad (2)$$

$$F_a = R_{xo}/R_{mf} \quad (3)$$

Where:

F = formation-resistivity factor

R_o = resistivity of a formation 100% saturated with water of resistivity R_w

R_w = resistivity of interstitial water

R_t = true formation resistivity

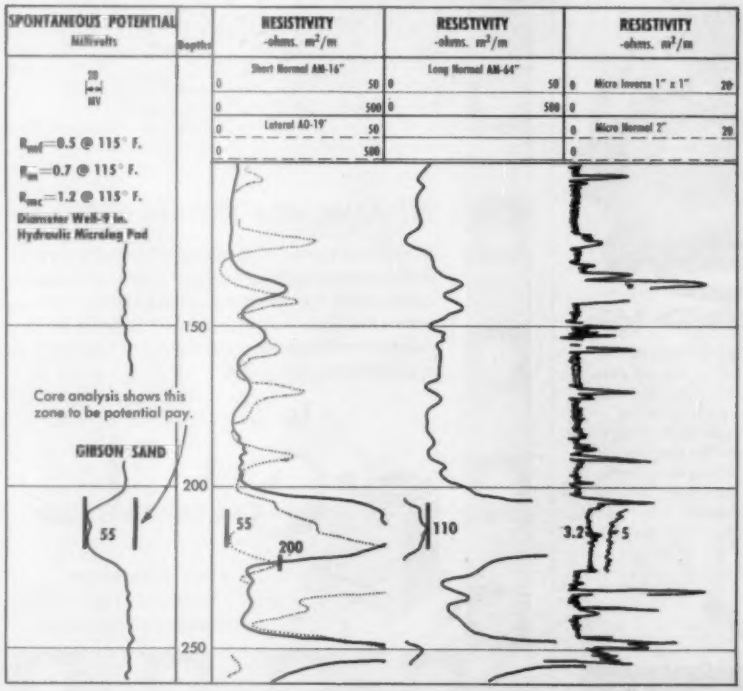
S_w = interstitial-water saturation, fraction of pore volume

F_a = apparent formation-resistivity factor

R_{xo} = resistivity of flushed zone (close to borehole)

R_{mf} = resistivity of mud filtrate. (Normally not given at formation temperature but can easily be converted to same by use of Chart A-6 of Reference 2.)

SOLUTION: Fig. 1 shows the electric and contact logs for the Gibson sand in an Oklahoma well. The SP and resistivity readings for the curves are indicated as:



ELECTRIC AND CONTACT LOGS for a well showing responses in Gibson sand. Fig. 1.

$R_{1''\times1''}$ = resistivity of microinverse

= 3.2

$R_{2''}$ = resistivity of micronormal

= 5.0

R_{mc} = resistivity of mud cake

= 1.2 (measured at formation temperature, 115° F.)

R_{mf} = 0.5 at 115° F.

$$\frac{R_{1''\times1''}}{R_{mc}} = \frac{3.2}{1.2} = 2.67$$

$$\frac{R_{2''}}{R_{mc}} = \frac{5.0}{1.2} = 4.17$$

In Part 3[1] of the series a chart was presented which related the above ratios with R_{xo}/R_{mc}. This chart was applicable for an 8-in. hole. The same chart can be used for a 9-in. hole if the $R_{1''\times1''}/R_{mc}$ ratio is multiplied by 0.96 (Chart C-3 of Reference 2). Thus:

$$(R_{1''\times1''}/R_{mc})_{corr.} = 2.67 \times 0.96$$

$$= 2.56$$

and

R_{xo}/R_{mc} = 27 (From Fig. 2, Part 3[1])

$$R_{xo} = (27)(1.2) = 32.4$$

$$F_a = R_{xo}/R_{mf} = 32.4/0.5 = 65$$

Using this value for the apparent-formation factor, a given residual-oil saturation of 20.0%, and Fig. 2:

$$F = 41$$

$$\phi = 14.3\%$$

Thus F and R_w are now known for the solution of Equation 2. For estimating R_t, the long normal, $R_{64''}$ and/or the lateral, $R_{18'8''}$ is usually used. The long normal can be used if $(R_{16''}/R_m) < 10$ (Chart B-8 of Reference 2). In this case $R_{16''}/R_m$ = 55/0.7 = 79 which exceeds 10 and therefore the long normal cannot be

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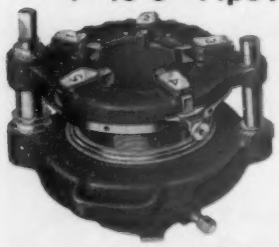

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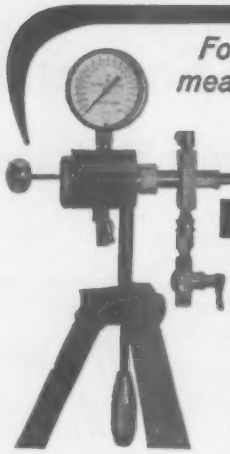

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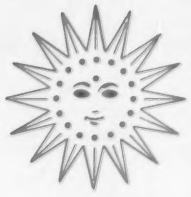

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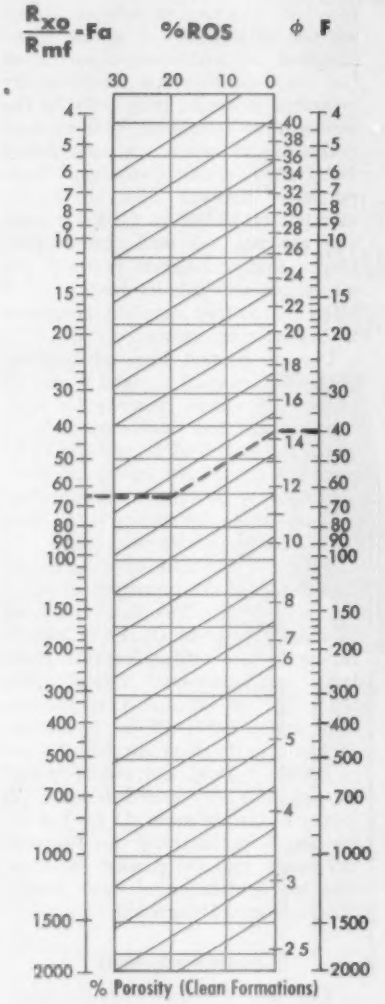


NOMOGRAPH for finding formation factor and porosity. Courtesy Schlumberger Well Surveying Corp. Fig. 2.

used. The selection of the appropriate rule concerning the use of the lateral curve depends principally on the gross thickness of the formation. In this case the gross thickness is about 20 ft. and for such a thickness the maximum reading is a good estimation of R_t if $R_{16''}/R_m < 50$ (Chart B-8 of Reference 2).

$$R_{18'8''} = 200$$

Since $R_{16''}/R_m = 79$ this value must be corrected for drilling fluid and hole effect in order to obtain a value of R_t. This is performed with the aid of Fig. 3.

$$R_{18'8''}/R_m = 200/0.7 = 286$$

and

$$R_t/R_m = 170 \text{ (Fig. 3)}$$

$$R_t = (170)\,(0.7) = 119$$

Therefore

$$S_w = [(41 \times 0.088)/119]^{1/2}$$

$$= (3.61/119)^{1/2} = (0.0303)^{1/2}$$

$$= 0.174 \text{ or } 17.4\%$$

DISCUSSION: This problem shows some of the complexities involved in finding interstitial-water saturation from electrical-survey data. In this case R_w was given as a measured value. Often such a value is not available and has to be found from mud resistivity and SP data and the use of this relationship:

$$SP = -K \log R_{mf}/R_{we} \qquad (4)$$

Where:

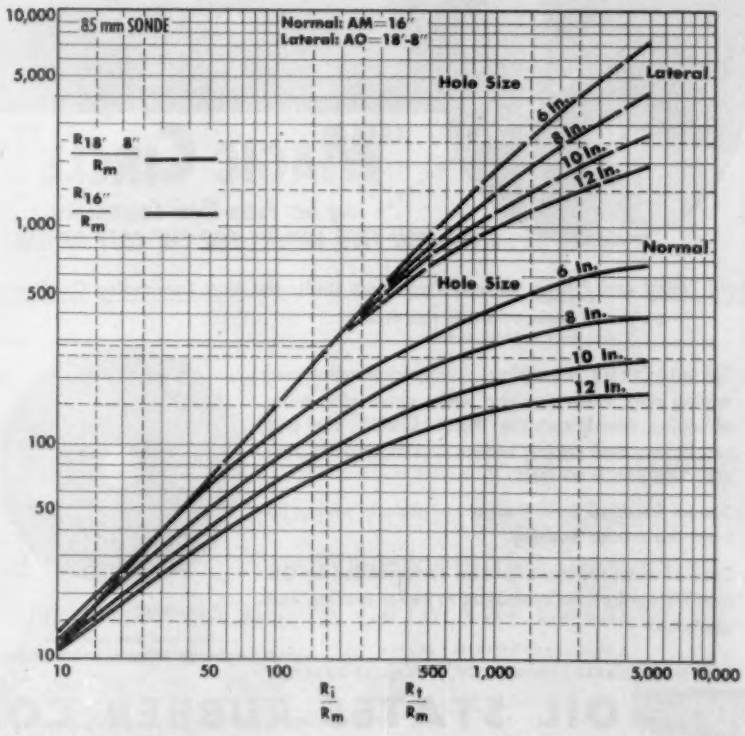
S.P. = spontaneous potential
K = coefficient
R_{we} = resistivity of water containing mixture of electrolytes

Often the SP read on the log is an apparent value and must be corrected. SP is caused by the movement of ions from the interstitial water in a porous rock into the borehole in an effort to equalize the activities of the water and the mud fluid.[4] The magnitude of the SP is affected by the salt concentrations of the water and drilling fluid, bed thickness, borehole diameter, shale in bed, and invasion. The true SP is a result principally of the differences in salt concentration between the interstitial water and drilling fluid.

As a result of the method used to measure it the SP decreases as a bed becomes thinner, as amount of shale in a bed increases, and as hole diameter and invasion increase.[4] Methods to correct for these various effects have been developed.[2]

In Equation 4, K is a factor dependent on formation temperature[2] and R_{mf} has been related to R_m by laboratory studies.[2] Having determined values for SP, K, and R_{mf}, R_{we} can be computed. R_{we} is often nearly equal to R_w but when the formation waters are either fresh ($R_w > 0.2$) or very saline ($R_w < 0.05$) some deviations occur.[4] In both cases R_w is actually greater than R_{we}. Based on theoretical and experimental work, Gondouin et al.[4] developed a chart relating R_{we} and R_w.[2,4]

It is not always possible to measure R_o and it must be computed from a knowledge of F and R_w (Equation 1). As pointed out above, R_w is determined using the SP reading. F is best gotten from the ratio of the resistivity of the invaded zone to the mud filtrate resistivity corrected for residual-oil saturation (Equation 3 and Fig. 2). As noted in this problem,



SIMPLIFIED RESISTIVITY departure curves. Courtesy Schlumberger Well Surveying Corp. Fig. 3.

a good method for obtaining F involves the use of contact log data. Generally the measured resistivities are functions of the resistivity of the flushed zone (R_{xo}), residual hydrocarbon saturation (ROS), hole diameter, resistivity of mud cake, and thickness of mud cake.[5] As pointed out in the solution of the problem, graphs have been developed based on laboratory measurements relating the contact log readings with R_{xo} and taking these factors into consideration.[2]

Note on Fig. 1 that the formation of interest has been found to contain hydrocarbons by core analysis. A formation containing hydrocarbons normally shows a higher resistance than one containing only brine. However, the absence or presence of resistance is not always an assurance that hydrocarbons are not or are present. The true resistivity of a bed is a function of hydrocarbon saturation, interstitial water salinity, porosity, and cementation.[6]

Decreasing salinity and porosity and increasing cementation cause the resistivity of a rock to increase. Hence the use of Equation 2 in the determination of hydrocarbon saturation ($1 - S_w$) assumes that the resistivity measured is caused principally by the hydrocarbon saturation. This assumption is not bad when it is remembered that many clean formations have porosities between 20.0 to 30.0% salinities of 30,000 to 60,000 p.p.m., and are not too well consolidated. Under such conditions porosity, cementation, and salinity have a small effect on the true resistivity compared to hydrocarbon saturation.

Use of contact logs, as outlined here, in estimating S_w (and ϕ and F) becomes unreliable generally for tight, highly cemented formations. As a guide, the values of S_w, ϕ, and F, so obtained, should not be trusted without checking by other methods when the porosity so determined is less than 15% and F_a greater than 100.

Thus far problems have been presented on the determination of water saturation from log data involving an electrical survey (Part 27), electrical survey and contact log (this problem), and shaly-sand interpretation (Part 5, The Oil and Gas Journal, February 9, 1959). Other applications of this type of data involve the use of (1) SP, normal, and induction log[2] for use with very resistive muds, (2) Rocky Mountain method,[2] (3) Laterolog and Microlaterolog[2] for use with salt muds, and (4) porosity balance[7] used for verification of water saturation determined from log data.

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Acknowledgments

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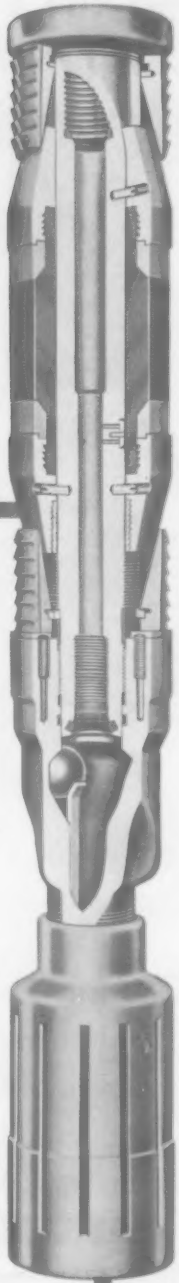

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Design of sucker-rod strings (continued)

BY JOSEPH ZABA

IN DESIGN of pumping installations the known data include the amount of fluid to be pumped in 24 hours, setting depth of the pump, height of the working fluid level, and properties of the fluid. For these conditions the pump size, speed, stroke length, and size and type of rods are tentatively selected. Calculations are then made to check the tentative selection.

Since the rods support not only the fluid load but also their own weight it is apparent that the loading of a rod string increases progressively from the bottom of the well toward the surface. With increasing pumping depth, the tapered rod strings came into general use. These strings consist of two or more sizes of rods with the largest rods toward the surface. Use of tapered strings results in decreased loads and cost, and provides for more uniform distribution of stresses in the rods.

Straight-rod strings. One way of designing the straight-rod strings may be shown by this example:

Assume pump setting depth of 4,000 ft., working fluid level at the pump, fluid gradient of 0.43 psi. per ft. (water) corrosion inhibited with 100% efficiency. Fluid requirements are such that 1¼-in. plunger pump, at 14 s.p.m. and 48-in. stroke have been selected. Carbon-manganese steel rods of ⅝-in. size with working stress of 29,000 psi. will be used. The steps of calculation are:

1. For 1¼-in. plunger the fluid weight per foot is 0.528 lb. (Table 7, Part 19). For the assumed conditions the total weight of fluid on the plunger is 4,000 × 0.528 or approximately 2,100 lb. At 14 s.p.m. and with a 48-in. stroke the acceleration factor of the Mills formula is 1.133 (Table 2, Part 7). Therefore, the accelerated weight of fluid is 2,100 × 1.133, or approximately 2,400 lb. Use of full area of the plunger in calculating the fluid load and of accelerated well load provide in this method safety factors considered necessary because of the many unknowns involved.

2. The load which a ⅝-in. rod with a working stress of 29,000 psi. can handle is around 9,000 lb. (Fig. 25, Part 19).

3. The difference between 9,000 lb. and the accelerated fluid load of 2,400 lb., or 6,600 lb., represents weight of string which rods can handle.

4. The weight per foot of ⅝-in. rod is 1.16 lb. (Table 5, Part 19). The accelerated per foot weight of rods is 1.16 × 1.133, or 1.31 lb. per ft.

5. Since the rods can handle 6,600 lb. of their own weight, 6,600/1.31, or 5,037 ft., represents the length of the string the rods can handle without being overstressed. Since only 4,000 ft. is needed, the selection of the rods was correct.

6. To check on the range of stresses, the maximum polished-rod load equals fluid load of 2,400 lb. plus the accelerated weight of rods, 4,000 × 1.31 or 5,200 lb. in round figures. The maximum load is, therefore, 7,600 lb. Buoyancy is neglected to offset friction which cannot be calculated.

The minimum polished-rod load (formula in Part 7) is 4,000 × 1.16 × (0.873 − 0.133) or 3,400 lb. in round figures. The range of stresses is, therefore, 7,600 − 3,400 = 4,200 lb. This is around 55% of the maximum stress which is not excessive.

Tapered-rod strings. There are two general methods of designing a tapered-rod string. The first method assigns to each of the graduated sections of the string its maximum stress. In other words, a point in the string is determined at which the stress in the rod equals the arbitrarily selected maximum working stress and from this point up a larger size rod is used. Under the second method the string is designed so that the stresses are equal in the top rod of each of the different-size sections of the string.

Use of the first method results in rod strings which are lighter and less expensive than the strings designed by the second method. Some operators have good experience with the first method and are using it. Others believe that possibility of existence of stress raisers and of loads being higher than calculated justifies use of safer strings and prefer second method.

Tapered-string design—first method. The string may be designed in the same manner as the straight-rod string. The only difference is the fact that when the length of the bottom portion of the string is determined, this length is not sufficient to reach to the surface and the length of the next portion of the string is calculated. Or, the lengths of the different portions of the string are calculated by formulas evolved as follows:[1,2]

The size of the rods in a string has to be increased at a point where the safe working stress equals the stress brought about by the accelerated weight of fluid plus the accelerated weight of rods. Expressing this in terms of loads,

$$Sa_1 = W_f C + R_1 W_1 C \qquad (1)$$

where:

- S = maximum selected safe working stress of rods, psi.
- a_1 = area of bottom section of rods, sq. in. (Table 5, Part 19).
- W_f = weight of fluid, lb. (Table 7, Part 19, taking into consideration depth to pump).
- C = acceleration factor (Table 2, Part 7).
- R_1 = length of bottom section of string, ft.
- W_1 = weight per ft. of bottom section of rods, lb. (Table 5, Part 19).

Solving for R_1:

$$R_1 = \frac{Sa_1 - W_f C}{W_1 C} \qquad (2)$$

For second section of rods:

$$Sa_2 = W_f C + R_1 W_1 C + R_2 W_2 C$$

$$= Sa_1 + R_2 W_2 C \qquad (3)$$

where:

- a_2 = area of rods in second section of rods, sq. in.
- R_2 = length of second section of rods, ft.
- W_2 = weight per ft. of second section of rods, lb., and other symbols are as in Equation 1.

Solving for R_2:

$$R_2 = \frac{Sa_2 - Sa_1}{W_2 C} \qquad (4)$$

Similarly for the third section, if needed:

$$R_3 = \frac{Sa_3 - Sa_2}{W_3 C} \qquad (5)$$

where R_3, a_3, and W_3 denote respective properties of the rods in the third section of the string. Other symbols are as in Equation 1.

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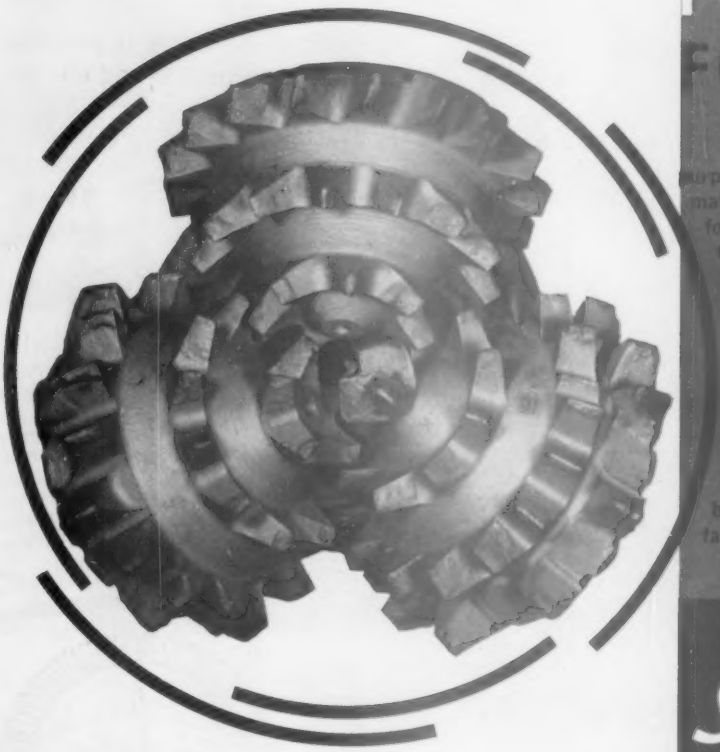

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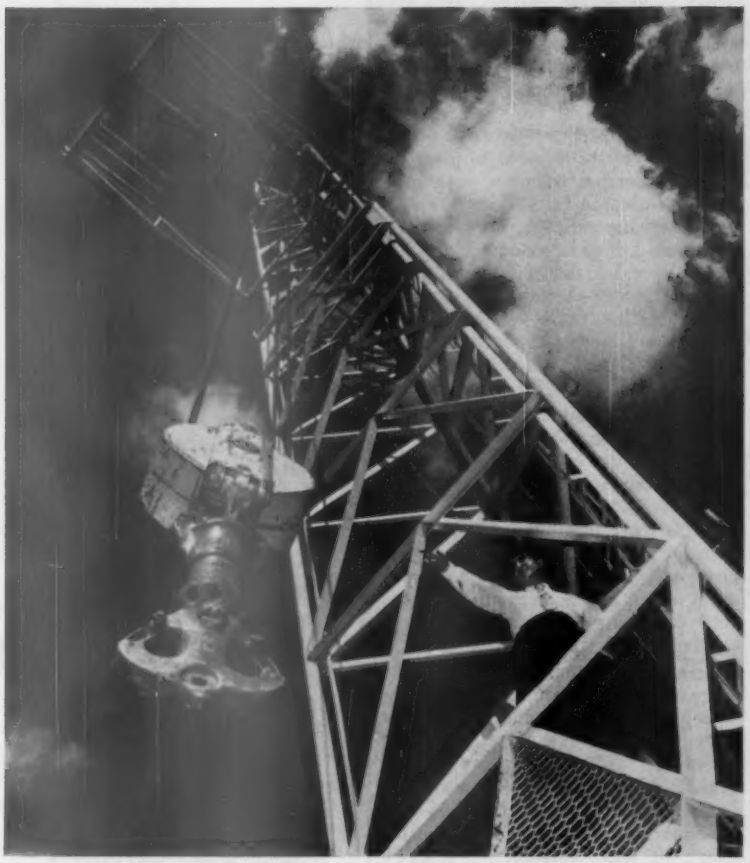

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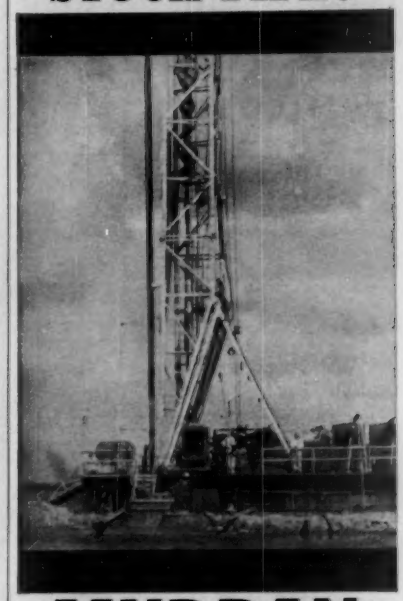
The new structure has unusually clean lines, because of the cleanness of bracing. The rig is more stable in wind than other types of derricks because of lower wind resistance.

The standard crown provided on the derrick allows a four-line string up to the block without crossing lines. This is possible by the use of an offset sheave on the back side of the crown. Block twist is also eliminated.

The design of the derrick allows a significant weight reduction with the elimination of a fourth leg. The crown is positioned on the derrick so that all three legs are working legs—such as with a tripod. This provides maximum column capacity to be realized for any particular leg section.

Raising is accomplished through the

STUCK PIPE?



MUDBAN

Mudban*, Dowell's low-cost mud-dispersing agent, is designed to make quick work of loosening stuck drill pipe. Mudban is used to remove filter cake from formation face. Also used effectively in well clean-out work. A little goes a long way. Be ready. Keep a can of Mudban on hand. Available from all 150 Dowell offices and stations.

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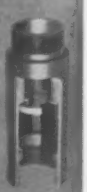

● MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.

● MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.

● The replaceable SYNTHETIC RUBBER GUIDES in MARTIN CAGES last longer than any metal, and the cushioning of the ball increases your ball & seat life. Results are often truly amazing. (Patent No. 2,591,174)

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use of one double-action three-stage hydraulic ram. This allows safe, positive control of the derrick from initial raising through the breakover to the final tilt position. It eliminates the use of gadgets to pull the derrick back over center during the lowering of the structure.

Tilt is adjusted by a single-point-kicker screw with a lock plate to snub the derrick when in position—a feature used on Franks derricks over the years. Extending is accomplished by means of an extending cable actuated by either the main drum or an optional derrick-extending winch. The extending line exerts an even, centralized pull on the upper section, resulting in a safe, smooth extending cycle.

The derrick load is transferred from the upper section to the lower section through the use of an automatic pawl and seat on each of the three derrick legs. The actuating mechanism which controls these pawls is interconnected to assure that all three pawls engage positively. This feature provides maximum safety. It is actuated by the cable-extending line during the extending or telescoping cycle.

Standard equipment includes the derrick (basic structure), crown assembly (line size optional), offset crown sheave (line size optional), crows nest, ladder, front guy lines to vehicle, pawl-locking mechanism, hydraulic raising system, fast line and deadline tieback spool, tilt-indicator gage, tilt lock assembly, and block cradle.

Optional equipment includes the racking board, combination rod board and rod hangers, automatic folding of racking board, automatic raising of rod board, air-lift rod transfer, adjustable working platform, derrick lighting system, catline sheave—either side of crown, rod holdback assembly, ground guy lines—derrick and racking board.

Tri-Scope derricks are available in 90, 84, and 69-ft. sizes. The 90-ft. derrick is recommended for replacing double-pole masts in rod and tubing work. The 69-ft. derrick is the smallest derrick in the Franks line of well-servicing equipment. The new structure may be ordered with original equipment or installed on present equipment with a minimum of modification.

The 90-ft. derrick has a 100,000-lb. capacity. Roading length is 56 ft. API static-rated hood load with four lines, 100,000 lb. (4° tilt angle). Racking capacity for doubles: 2-in. E.U., 16,500 ft.; 2½-in. E.U., 13,500 ft. Rod capacity for triples: ¾-in. rods, 15,600 ft.; ⅞-in. rods, 13,650 ft.; 1-in. rods, 11,700 ft.

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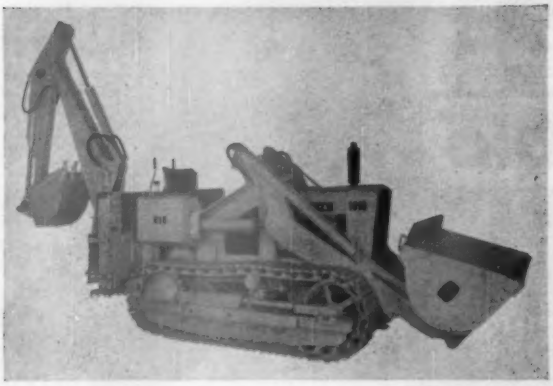


Choice of tractors

. . . and auxiliary equipment is offered by a new line. Two crawler-tractor series are offered in 40 and 50 engine hp. sizes. Wheeled tractors offered include four models of 40, 50, 60, and 85 engine hp. All tractors have power-matched equipment and feature new variable-speed engines. All machines may be powered by gasoline or diesel engines.

On the crawler-loader units, one lever controls all movements of both the loader lift arms and the bucket. On the crawler tractors, a T-bar control for all hydraulic bulldozers will command the four operating functions: angle, tilt, lift, and cut. Source: **Deere & Co., Moline, Ill.**

●

Wall-mounted fluid filters

. . . now being produced are compact and offer a way to save floor space. The filters are suited for water, oil, and chemicals, either hot or cold. They are expected to find a variety of uses such as for prevention of nozzle plugging, elimination of pipe scale, clarification of viscous liquids, for protection of valves and meter, and related uses.

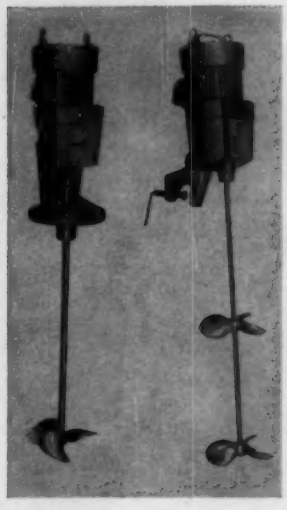
The elements reportedly will withstand 150-psi. differential pressure without collapse. One interesting feature is that the filters use quick couplings for fast servicing. The filters come in capacities from 5 to 350 g.p.m.; pressures to 200 psi.; temperatures to 450° F.; materials of bronze, steel, monel, and aluminum; and duplex, triplex, and quadruplex construction. Source: **Ronningen-Petter Co., Vicksburg, Mich.**

●

Lost-circulation

. . . material now on the market consists of three components: ground and graded granular plastic, ground and graded hard nutshell, and high-strength inert fiber. Tradenamed Poly Plug the product is now offered in a course grade with a maximum particle size of ¼-in. Source: **Cherokee Laboratories, Inc., Box 587, Tulsa, Okla.**

●



Mixer

. . . promises high efficiency and convenient handling for fluid agitation in process work. Designed as an integral unit, the Lightnin propeller type of portable mixer comes in ratings from ⅛ to 3 hp., direct-drive speeds of 1,750 and 1,150 r.p.m., and gear-drive speed of 350 r.p.m. Both types rotate clockwise. The mixers features a positive-drive chuck that permits fast coupling and is always located above the maximum fluid level in the mixing tank. Source: **Mixing Equipment Co., Inc., Box 1370, Rochester 3, N. Y.**

Want more facts about equipment or copies of product literature described in this issue?

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High-energy electric-arc heater

. . . has been devised which is said to be potentially capable of supplying a stream of gas at a temperature of 20,000° F. and at pressures up to 15,000 psi.

One potential use of the machine is as a chemical synthesizer where it will supply the high temperatures necessary for inducing difficult chemical reactions. One example cited by the maker is the combining of oxygen and nitrogen in the heat chamber to form nitrous oxide. The heater also is expected to find use in processing petroleum products. Source: **Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Pa.**

Sprayable plastic coating

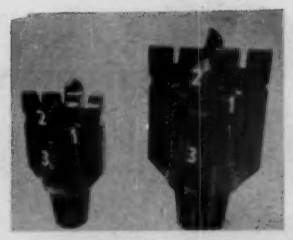
. . . of Penton a chlorinated polyether polymer, in water suspension, recently brought out promises to prove valuable to protect process equipment from corrosion. The product, called Pfaudlon 301, can be put on in thicknesses of 20 to 40 mils with as few as two applications. The product offers several advantages. Parts do not require preheating and complex shapes can be easily covered. Source: **Pfaudler Co., West Ave. and Clark St., Rochester 3, N. Y.**

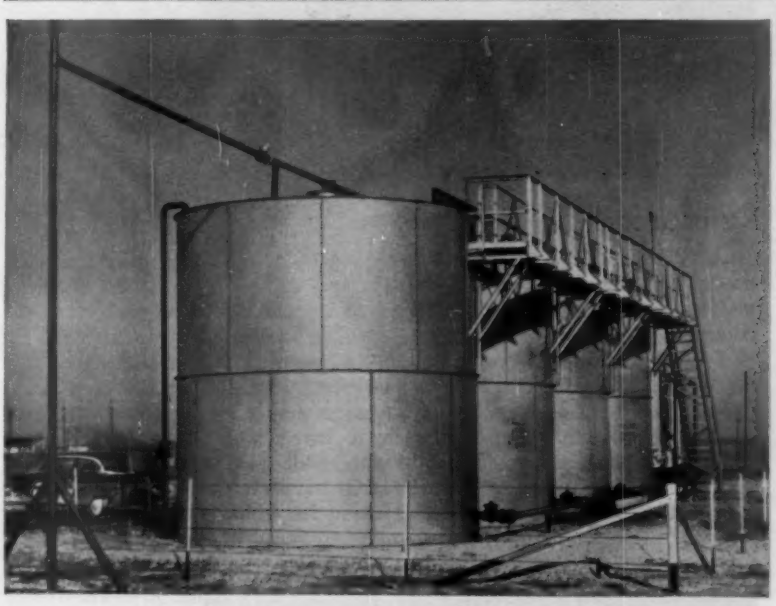
Tungsten-carbide rotary drill bit

. . . is now available that is designed for operation with no blocking of the jet stream. The maker sets forth the following features:

Four streams jet over three-fourths of the center of the hole being drilled. The jet stream outlets are within 2 in. of the face of the hole.

The bit is designed to prevent blocking by cuttings entering the return annulus. Weight of the bit does not retard the jet streams cutting into the formation, and there is no bottom hole pressure from the bit's weight to retard cutting of the formation by the jet streams. The bit body is of solid one-piece construction. Source: **Phipps Drill Bit Co., E. Main, New Iberia, La.**





Quality and service make Butler tanks your best buy

Experience creates quality. And Butler bolted steel tanks have been used for petroleum storage for over 45 years. You get tight, safe tanks – pre-engineered to exacting A.P.I. standards – in a range of capacities from 100 to 10,000 barrels.

What's more . . . your Butler tank distributor is set up to give you the fastest possible service when your well comes in. He stocks a full assortment of tanks, stairways, walkways and equipment in key oil producing areas. And his well-trained crews offer fast, expert erection service.

For famous Butler quality – and fast service when and where you need it, call your nearest Butler tank distributor. He is listed below.

Flowers Tank Co., New Harmony, Indiana; Greensburg, Ky.

Delta Tank Manufacturing Co. Inc., Baton Rouge, La. Branches and offices throughout Mid-Continent, Gulf Coast and Rocky Mountain oil fields.

Canadian Distributor – Oil Field Services, Ltd., Estevan, Saskatchewan; Edmonton, Alberta

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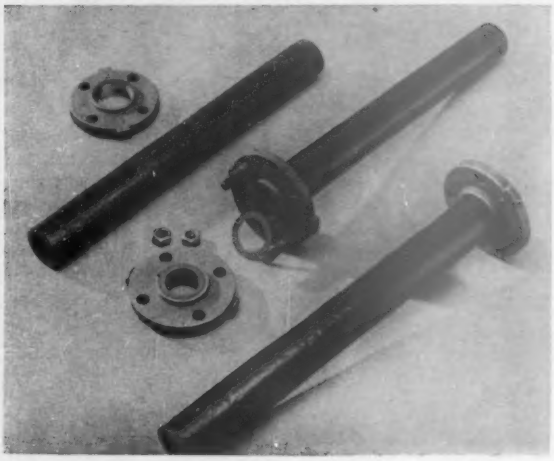
SHOWCASE . . .

New Equipment



Reinforced plastic pipe

. . . now being marketed installs easily, according to the maker, and is particularly suited for use in processing and transferring of acids, alkalies, and solvents. Called Eonite, the pipe can carry without distortion or deterioration, corrosive liquids and gases at temperatures up to 300° F. and pressures up to 150 psig., the maker claims. The pipe is designed for assembly with a ring-lock type of joint which includes two cast-iron ASA flanges, two tapering rings, and an asbestos gasket impregnated with neoprene and graphite. Pipe can be cut to length with a hacksaw.

The pipe comes in 15-ft. lengths with inside diameters from 2 to 12 in. and wall thicknesses of 5/16 to 9/16 in. Source: **Cornelius A. Rauh & Assoc., Inc., 1191 Sunset View Dr., Akron 13, Ohio.**

●

Compact pressure regulator

. . . comes in capacity ranges equal to those of conventional regulators of much larger size for pressure-reducing, backpressure, and combination pressure-reducing and relief service.

The pressure-reducing model of the Mity-Mite regulator comes in sizes from ¼ through ½ in. for inlet pressures up to 10,000 psi. and adjustable controlled pressures up to 6,000 psi. The combination pressure-reducing and relief regulator comes in sizes of ¼ through 1 in. for inlet pressures up to 6,000 psi. The backpressure model comes in a ¼-in. size for pressures up to 3,000 psi. Source: **Grove Valve & Regulator Co., 6529 Hollis, Oakland, Calif.**

Industrial vacuum cleaner

. . . comes in nine models to provide combinations of motor capacities, tank capacities, tank materials, and accessory equipment for wet or dry cleaning or both, as well as for furnace cleaning and other special cleaning operations, the maker says. The smallest unit, the No. 25, is powered by a 1¼-hp. motor and has a 2-gal. capacity. It will stand, slide, or hang on a wall or post, or it can be carried on the operator's back to handle small-space cleaning jobs. The No. 95 cleaner for heavy-duty cleaning jobs is powered by a 2¼-hp. motor and has a 13-gal. capacity. Source: **Black & Decker Mfg. Co., Towson 4, Md.**

●

Portable system of communications

. . . a wired type now on the market, is claimed to give intelligible communications under any noise conditions, including jet-engine type of noise. It uses transistorized amplifiers combined with a variety of ear-phone-microphone headsets to form "wearable" units for almost any type of operation requiring wired person-to-person communications.

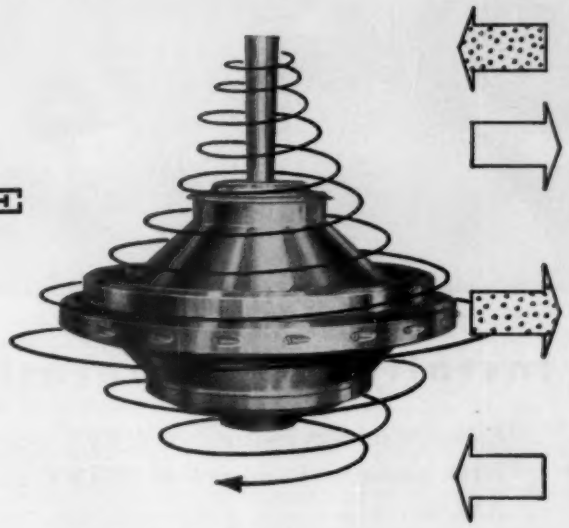
Two amplifiers are available: one for low to medium background noise; the other for higher noise conditions. Both are belt-clip type units with self-contained batteries and controls. Either amplifier for the Telepath system can be used with any of four

Process Trends from DORR-OLIVER

A SERVICE TO THE PROCESSING INDUSTRIES

THE CENTRIFUGE TAKES OVER

A long-neglected equipment item is developing into a giant that is starting new trends in processing operations



Although the centrifuge has been with us for a long time, its full potentialities are only now being realized in the processing field. Partly, this is due to the increasing demand for faster, more precise methods of separation and classification, adaptable to continuous, automatic operation. More particularly, it is due to radical new developments in the centrifuge itself.

Centrifuges have now become so versatile in operation and have advanced so much in size, power and capability that opportunities for profitable application are virtually unlimited. They are replacing filters, settling tanks, screening and other separation and classification equipment. In many cases, they are cutting days off processing time. Important, too, since the centrifuge substitutes horsepower for size, is the greatly reduced floor space requirements and the smaller amount of critical material needed when handling highly corrosive solutions.

Dorr-Oliver has taken a leading part in the development of these newer, more versatile and more powerful units. An example is the high speed, high pressure Merco® centrifuge for operation at elevated temperatures. A successful application is in separating the catalyst from the polymer in the production of the new high density polyethylene.

Features of Dorr-Oliver design are the overhead bearing and drive which remove some of the limitations of conventional units and the revolutionary return flow principle that permits concentrating, washing, clarifying, classifying and recovery of soluble values at pressures up to 150 psi. Probably the largest centrifuge now in operation is a Merco unit. Rotor speeds up to 3300 rpm and capacities up to 600 gpm are possible. Smaller size, specialized units, among them the Mercone® Screening Centrifuge, are finding application in the food and pharmaceutical industries.

To those interested in the possibilities of centrifugation, Dorr-Oliver offers a wealth of information. For investigation and evaluation, pilot plant models are offered on a sale or rental basis. Just drop a line to Dorr-Oliver Incorporated, Stamford, Connecticut.

Dorr-Oliver offers a wide range of equipment, methods and complete systems for the processing industries. Operations include:

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headsets offered. All units provide "hands-free" operation. For most applications, the distance between separate units is said to be unlimited. Party-line operations with three or more units working together is possible. Source: **Seiscor Div., Seismograph Service Corp., Box 1590, Tulsa, Okla.**

•

New hanger

. . . for rig lights contains a molded neoprene element. This special feature is said to give longer bulb and fixture life. It does this by absorbing rig vibrations and dampening shock. Also, metal to metal contact is avoided.

The positive locked element is said to make a safety chain unnecessary. The Save-A-Lite cushion hanger is designed so fixtures can be mounted vertically or horizontally. Source: **Rig-A-Lite Co., 2102 69th, Houston 11, Tex.**

•

TV camera

. . . for dimly lighted areas now being produced is small, lightweight, and completely transistorized. The Dage Model 81 industrial camera operates remotely from the camera control. A transistorized preamplifier is mounted within the camera. Its output is used to drive a low-impedance coaxial cable. The camera-adjustment controls, beam, target potential, and electrical focus appear on the front panel assembly, as do the function controls for remote-controlled accessories. Source: **Dage Television Div., Thompson Ramo Wooldridge, Inc., Michigan City, Ind.**

HOKE Flow Sheet 3

HOKE REPORTS ON FLUID CONTROL

WE'VE TOSSED A NEW BALL INTO AN OLD GAME

Do You Have A Bomb In Your Lab?

In the process industry, sampling cylinders are occasionally referred to as bombs. In recent months, this misnomer has been, unhappily, pretty close to the truth. Some military surplus, low carbon steel, two-piece cylinders have found their way into industry and have been used beyond their rather limited capabilities. Unfortunately, several serious accidents have spotlighted this use as a very real safety problem.

Since sampling is such a serious business, we have perfected, for maximum safety, a seamless, one-piece cylinder. This unabashed declaration of excellence has sound

basis in fact – the entire cylinder is formed from a single piece of seamless type 304 stainless steel tube. To quell the qualms of process men, sample contamination is practically nonexistent, and the cylinder resists destruction from most corrosives.

As a further safety guarantee, all standard sampling cylinders are fabricated to meet ICC and other safety regulations. Standard cylinders are available at pressures to 1800 psi (10 ml. to 1 gallon), but higher pressure cylinders can be had on special order.

If you'd like additional information on Hoke cylinders, plus a detailed paper on the various methods of collecting samples from process lines, drop us a line. We'll also include details on special cylinder valves, outage tubes and other cylinder accessories.

The technique of molding polyvinyl chloride into ball valve parts is old hat. Even the unplasticized compounds of type I PVC have been kicked around for a while (with minor successes). But until now, no one has booted the ball for a goal.

Perseverance, determination, and the pursuit of economic reward have prompted us to offer a line of ball valves molded of the toughest grade of type I, unplasticized PVC. There are no foreign agents to contribute to a corrosive demise, even in most caustic services. It even meets the proposed new ASTM specification and has a tensile strength of 8500 psi. Those who have had PVC piping problems will profit from the new molding process that gives these Hokes dimensional stability and very high impact strength. Sensitive systems, human and otherwise, are safe from contamination – they're absolutely non-toxic. We've set 140°F. as the operating temperature limit, but occasional excursions to 160°F. won't do any harm.

All standard models are supplied with a concentric hole drilled thru the ball. They can be heat welded, or solvent bonded right in the line. Piping hook-up is even simplified by their coupling-like assembly. Your assistant can fit each half of the valve to a pipe end, then reassemble the valve without having to turn the pipe. Pressures to 125 psi are duck soup for these valves.

A maintenance man's delight, they can be cleaned and have their seats changed without leaving the pipe. Their light weight makes them ideal for use on long, unsupported spans of pipe.

Size-wise, we're offering them in ½, ¾, 1, 1½, 2, and 3 inch sizes, all NPT female connections.

You will command the eternal admiration of your colleagues when you install these valves. Be the first to show your rightful status by ordering a shiny new Hoke polyvinyl chloride ball valve. If pride of ownership hasn't motivated you at this point, the mere fact that you are behind the scientific times should move you to find out more.

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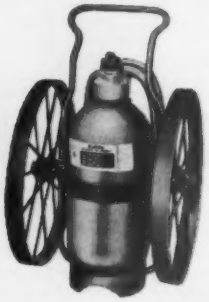
NOW! GET FULL-POWER FIRE FIGHTING WITH KIDDE'S DRY CHEMICAL LINE!

2½ and 5 pound pressurized units! Granted top rating by U.L., these two units pack the extra punch needed to get the jump on fire. For example, the 2½ pound Kidde unit is as compact as a 1 quart carbon tet model, yet is eight times as powerful! Both the 2½ and 5 feature simple, two-step operation, easy-to-read dust-and-moisture-proof gauges. 10 pound dry chemical also available.

20 and 30 pound pressurized dry chemicals! Both these Kidde units have the same good features of the 2½ and 5, plus some "extras" all their own. Center balanced for fast action, rugged diffuser horn, speedy trigger operation, recessed pressure gauge and enclosed mechanism.



200 pound dry chemical wheeled unit! Kidde's 200 pounder discharges a 40-foot stream faster, has an *extra* 50 pounds of fire-smothering dry chemical to knock down fire quicker. Low center of gravity and wide wheels make it easy to maneuver. Easy-to-use discharge control makes operation simple.

400 pound stationary unit! Here's maximum protection in a minimum package! Like all Kidde units, this features sure, dependable performance and fast, easy operation. Either wall-mounted or free standing, leakproof and tamperproof, exclusive Bridgeman Seal, universal long-range nozzle, easy-to-read pressure gauge. 200 pound model also available.

Get the jump on oil, gas and electrical fires! Learn more about the complete line of dependable, efficient Kidde equipment—write today!

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Chromatograph uses tape program

. . . for automatic process control. The instrument uses a motor-driven transparent film in conjunction with a photoelectric transmitter and receiver to achieve combinations of time and sequence as needed in process chromatography. The film is programed by graphite markings spaced to interrupt the photoelectric beam and effect such desired sequences as peak selection, range sensitivity, valve actuation, automatic zeroing of the detector cell, and visual read-out. Source: **Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.**

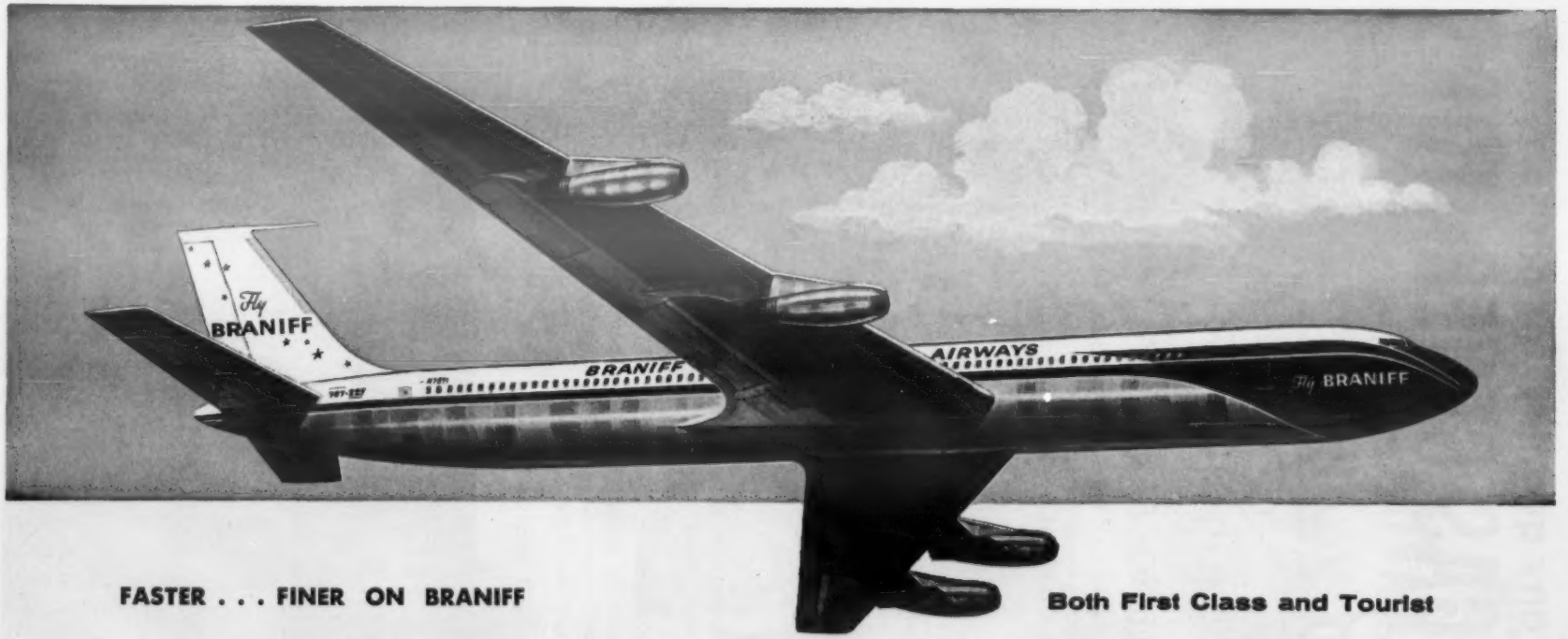
Antiknock compound

. . . for gasoline combines tetraethyl lead, tetramethyl lead, and mixed methyl ethyl lead compounds. According to the maker, laboratory and road tests indicate the product, called Tetramix, provides improved antiknock performance in many of today's gasoline blends. Source. **E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.**

Film-forming corrosion inhibitor

. . . recently announced is an oil-soluble film-forming type for general use in protecting drill pipe, casing, and tubing from corrosion. Called X-Cor, it may be used in drilling muds or packer fluids, the maker says.

The product is added to drilling or packer fluids to protect the drill pipe, casing, and tubing from hydrogen sulfide attack, oxidation, or the effects of electrolytes. The film is said to become so closely bonded to the metal that it is impregnable to water. Source: **Baroid Div., National Lead Co., Box 1675, Houston, Tex.**



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To produce inerts in any quantity, for any job . . .

KEMP INERT GAS GENERATORS

—are best 3 ways!

1. Easy to start, set and forget

With Kemp's unique carburetor and external test burner, you check the pre-mixed gas-air ratio *before* it enters the combustion chamber . . . start fast with the electric ignition. Then set the vernial dial and forget it! The carburetor maintains the exact air-gas ratio—no rechecking needed.

2. Precise fuel control

You'll find the Kemp Carburetor automatically pre-mixes and keeps gas and air at the exact mixture you wish. And no matter what the total demand or pressure changes in your supply line, this precise air-gas ratio is maintained at all times.

3. Automatic safety

Kemp safety controls eliminate the danger of flame-out. An electronic flame-failure control instantly, automatically cuts off the carburetor's gas supply. This control operates under all conditions . . . unaffected by moisture or combustion chamber pressure.

If you need inert gases for blanketing, purging and protective uses, write for Bulletin L-10 . . . or call in your Kemp Man listed in the yellow pages or the Chemical Engineering Catalog.

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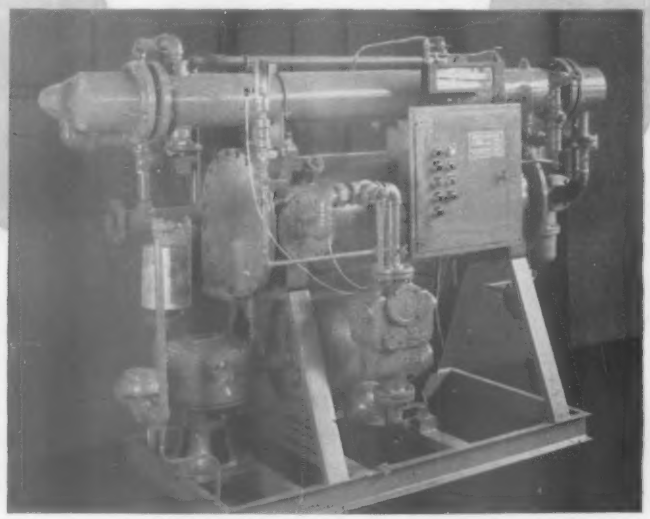
OF BALTIMORE



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MANUFACTURING COMPANY
405 E. Oliver Street • Baltimore 2, Maryland

Monitor

. . . will check 30 stations for process control to verify their condition with an accuracy of one part in a thousand, according to the maker. The instrument, called a Signal Sentry, is an all-solid-state monitor and alarm system measuring less than 42 in. high. Signals from transducers representing such variables as temperature, pressure, flow, and displacement are fed to the alarm system, and the allowable or permission values for each station are punched in advance into an IBM card. When the card is inserted in the front of the device, it checks the station against the prescribed value and provides an audible and visual information and electrical output when a station is about to exceed or has exceeded its allowed tolerance. Source: **Franklin Electronics, Inc., 5901 Noble Ave., Van Nuys, Calif.**

•

Miniature circuit breaker

. . . is available to protect your small motors driving portable power tools. It attaches to the end of the cord quickly and protects motors from burning out due to overload, according to the maker.

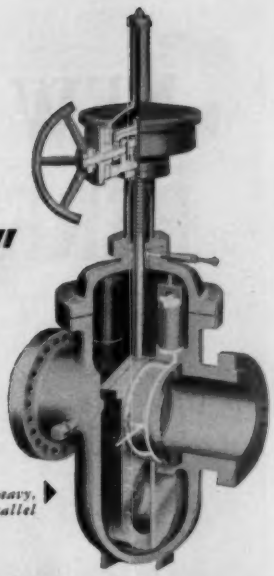
The motor protector automatically cuts off power when a machine is overloaded. A reset button is used to reset the circuit breaker. The device comes in ratings of 3 to 10 amp. Source: **Modern Mfg. Co., Inc., 680 Davisville Rd., Willow Grove, Pa.**

•

Heavy nameplates

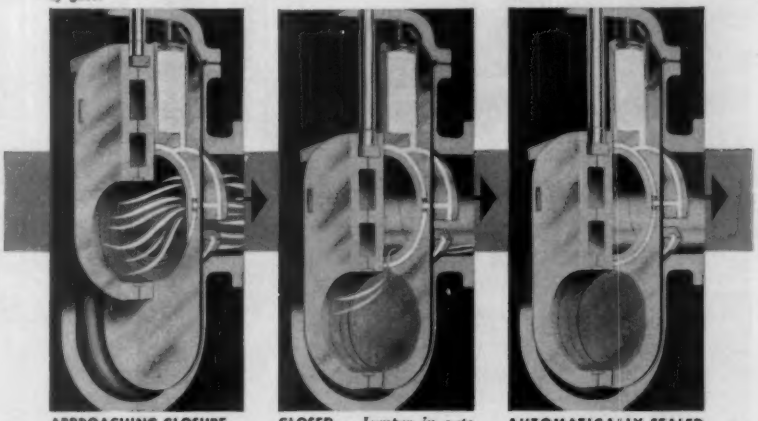
. . . are available in various weights, colors, and finishes either with pressure-sensitive adhesive or with holes for mounting with pins and rivets. Besides identification, the nameplates can serve as a reinforcing medium. Source: **C & H Supply Co., Inglewood, Calif.**

NEW ADVANTAGES "GO ON THE LINE" with DARLING-McEVOY Conduit Valves



RIGHT: *Cutaway showing heavy, self-aligning gate and parallel seat assembly.*

BELOW: *diagrams of closure action on downstream side of gate.*



APPROACHING CLOSURE... *No loss of sealant.*

CLOSED... *Jumper in gate permits differential pressure to feed sealant into seat groove.*

AUTOMATICALLY SEALED *. . Pressures again in balance. Tightness established.*

Compare these features with *any* other pipe line gate valve:

1. EVERY CLOSURE LEAK-PROOF
2. NON-DIRECTIONAL FLOW
3. TWIN SEALANT RESERVOIRS
4. NEGLIGIBLE SERVICING
5. SMOOTH, FULL FLOW
6. REPACKING UNDER PRESSURE
7. EXCEPTIONAL PERFORMANCE AND LIFE

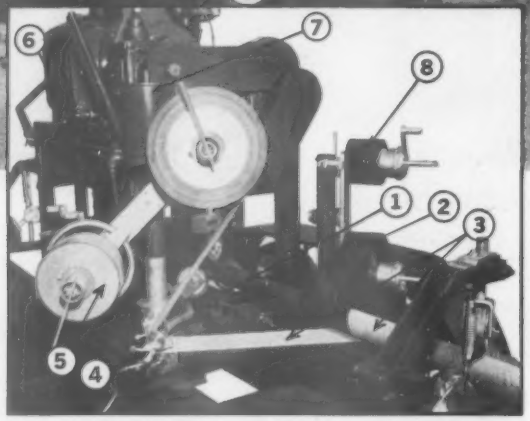
Darling-McEvoy conduit valves, made in 8″ and larger sizes, are fully field proved. Now operating continuously on various major lines. For complete information on the self-sealing feature and many other advantages of this unique valve, ask for Bulletin 5402.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

NEW TECHNIQUE ASSURES PERFECT ON-SITE COATING



Pipe (coming toward you) spins through machine . . . undergoes dynamic cleaning from twin-powered brush heads. Coating comes off brake-type tape drum. Outer wrapping runs through fast-gluing adhesive attachment.

1. Spinning pipe
2. Polyken tape coating
3. Outer wrap
4. Glue applicator
5. Stand-by outer wrap turret
6. Power brush heads
7. Glue tank
8. Stand-by tape turret

POLYKEN QUALITY PLUS UNIQUE APPLICATION METHOD MAKE TOP SITE-WRAP COMBINATION

Your protective coating results are only as good as the material you use and the way you put it on. And with Polyken tape . . . plus the special, new Polyken way of on-site application . . . you get a combination that really does a perfect job —*simply, speedily, economically.*

Simplicity? Right! The completely mobile machine sets up in an hour (knocks down in half that time), uses 6 men or less for continuous cleaning, coating, and wrapping. Speed? You can process up to 20,000 lineal feet a day, take 10-minute breaks to switch pipe sizes. Economy? Look at it this way: You get *quality* tape, properly applied by a high-speed *quality* process. The result can't help meaning more *dependable* coating for your dollar.

For the full story on both machine and tape, see your Polyken representative. It can mean maximum protection at minimum investment.

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Experienced in modern PROTECTIVE COATINGS

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Polyken Sales Division

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Midwestern Pipe Line Products Co.

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Experienced in modern
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SHOWCASE . . .

New Literature

Heat-resistant coatings

. . . to protect metal at constant heat at temperatures to 1,400° F. are discussed in a new 24-page publication now being offered to interested persons. Ten silicone and silicone-ceramic coatings cover a wide temperature range, air dry or heat cure in service, and are available in several colors as well as in aluminum. Use determines choice. Source: **Dampney Co., Hyde Park, Boston 36.**

New gate valve

. . . the 1000 series, is spotlighted in a newly published four-page publication packed with specifications, dimensional data, and weights. Applications include tank-battery installation, wellhead installation, and injection wells. Catalog 960 notes simplicity and performance of the valve, and includes operation and other informative data. Source: **Drilling Equipment Mfg. Co., Box 4728, Oklahoma City.**

Heat-transfer cements

. . . designed for use in temperature ranges from 600° to 1,250° F. in electric-resistance heaters, are highlighted in new four-page Bulletin 600 now available. Also introduced in the publication is high-temperature Thermon T-63, an inorganic, nontoxic, heat-transfer cement which conducts heat from electric-resistance-type heating elements to pipe, valves, tanks, etc. Source: **Thermon Mfg. Co., 1017 Rosine St., Houston.**

Stop vibration

. . . shock, and noise transmission by using steel-spring-machinery mountings which are described in Bulletin K3C. The six-page literature piece contains a series of eight typical case histories, complete with actual installation photos, showing how spring machinery mounts solved several vibration problems. Data tables gives capacities and characteristics of the Series L Vibro-Isolator, including isolator sizes, load capacities, dimensions, and shipping weights. Source: **Korfund Co., Inc., 48-42M 32nd Pl., Long Island City 1, N. Y.**

Now*... measure levels of any liquid in any container with this hermetically sealed

"dripless dripstick"

From table oils to toxic chemicals, the FRI "dripless dripstick" can accurately measure the contents of any container. Throughout the petroleum and chemical industry, wherever liquid levels must be determined, this easy-to-read indicator can do the job faster, safer, and with absolutely no contact of the indicator rod with the liquid to be measured. *Fully Tested in Use

How does it work? A doughnut shaped magnetized float (A) surrounds a guide tube (B) and rides the level of the liquid. A calibrated rod with a magnetic tip (C) is pulled out until magnets (A) and (C) engage. Then, the liquid level is read at point (D) outside the container. Request specifications and prices on your letterhead.

Mounts Top or Bottom

Flight Refueling, Inc.

COMMERCIAL PRODUCTS SECTION
BOX 1701 • BALTIMORE 3, MD.

Electronic "crowbar"

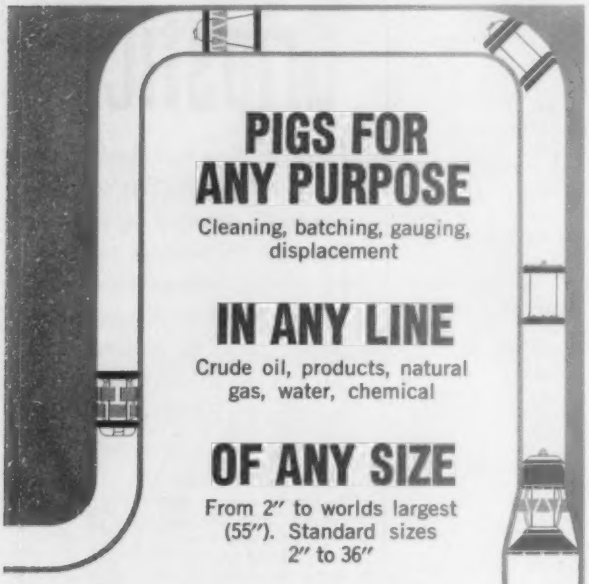
. . . that will instantly pry away an overload circuit to protect equipment is outlined in Application Note HV603. The crowbar functions as a circuit breaker or thyratron, yet doesn't use tubes, heated cathodes, or moving parts, the bulletin claims. When incorporated in the maker's standard and custom, high and low-current systems, the simple circuitry is said to provide a low-cost protective device which will operate within a few microseconds to protect both the power supply and critical loads from excessively high circuit surges. Source: **Sorensen & Co., Inc., Richards Ave., South Norwalk, Conn.**

Parabolic antennas

. . . for microwave service, mobile communications base-station antennas, and their associated cables and mounting accessories are described in two new catalogs, free to interested persons. Data on each antenna and accessory is placed adjacent to a photo and dimensional line drawing of the units. Catalog specifications include antenna frequency ranges, power gain, wind loading, type feed, cross polarity, plus the ordering code for job-packaged antenna systems. Source: **Prodelin, Inc., 307 Bergen Ave., Kearny, N. J.**

Automatic lubricator

. . . for plug valves is described in Bulletin V-617 which shows construction of the lubricator, tells how to install and operate it, and gives information necessary for adjustment. Source: **Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8.**



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Cleaning, batching, gauging, displacement

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Crude oil, products, natural gas, water, chemical

OF ANY SIZE
From 2" to worlds largest (55"). Standard sizes 2" to 36"

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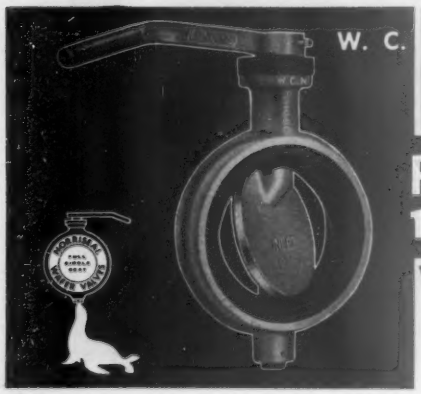

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The Beckman Hygrometer, equipped with the new hydrogen electrolytic cell, establishes new standards of accuracy for measurement of moisture in hydrogen streams. In the past, measurement of moisture in hydrogen has been marginal at best because of frequent catalytic reforming of H_2O within the cell, and subsequent remeasurement. ⌘ The new Beckman Hydrogen cell utilizes an element length where errors in efficiency and recombination are approximately equal and opposite, and hence cancel. Thus, you obtain readings of an accuracy heretofore unattainable. ⌘ If your problem is keeping hydrogen "dry" in process streams... in refining, catalytic reforming, and annealing, for example ...your nearest Beckman Sales Engineer can help you. Or write for application Data File 24-44-14.

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Scientific and Process Instruments Division
Beckman Instruments, Inc.
Fullerton, California

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Reduce Explosion Danger In Processing Operations

JZ INERT GAS GENERATORS

The only units designed and manufactured by burner specialists to eliminate the hazards common to inert gas generating.

MAXIMUM BURNER STABILITY FOR MAXIMUM SAFETY

- **Wide Turn-Down Ratio**
- **Minimum Corrosion...**

Combustion chamber is designed to minimize the formation of partially oxygenated and corrosive compounds

SIMPLE... RUGGED... COMPACT

The John Zink inert gas generator is so compact it requires less floor space than any other comparable unit.

Flanged components are used throughout for easy servicing. Each part may be removed without interfering with any other part.

The easy, economical way to provide maximum safety and efficiency for your plant and personnel in purging, storing, conveying and controlling in a variety of process operations.

WRITE FOR **BULLETIN G-59**

John Zink COMPANY

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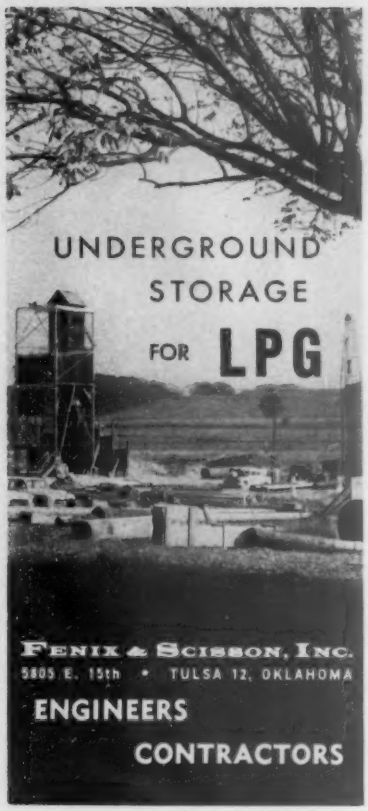

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Box 1260
TULSA, OKLAHOMA

Guide to controlling foam

. . . tells where and how silicones actually reduce processing time and maintenance costs while increasing production capacity and efficiency. The eight-page booklet—entitled "The ABC's of Defoaming"—lists applications in petroleum, asphalt, and chemical processing. Source: **Dow Corning Corp., Midland, Mich.**

Electric-motor

. . . bulletin illustrates examples of d.c. and a.c. motors covering a variety of supply voltages and frequencies. Sizes range from fractional-horsepower miniature motors to integral horsepower units of 25 hp. Included are examples of typical a.c. phasing capacitors and radio-frequency interference filters. Other examples of motor capabilities include several units capable of operating at 600° F. Source: **AiResearch Mfg. Co., Garrett Corp. 9851 Sepulveda Blvd., Los Angeles 45, Calif.**

Volatile-liquid pumps

. . . with capacities ranging from 40 to 10,000 g.p.m., are detailed in a new six-page publication just made obtainable. Bulletin 101 contains cross-section drawings of a conventional short-coupled vertical turbine pump and a canned-type vertical turbine pump. Uses and applications are illustrated. Source: **Layne & Bowler, Inc., Box 6697, Memphis, Tenn.**

Portable space-heater

. . . catalog contains specifications and information on selecting the correct heater on five different sizes ranging from 100,000 to 1,000,000 B.t.u. per hour. Four-page Catalog 6016 also illustrates different uses for the heater such as keeping workers warm, drying materials, thawing out equipment, and generally creating temporary heat for any area not provided with central heating. Source: **Stow Mfg. Co., 484 Shear St., Binghamton, N. Y.**

Two-pole crystal-case relay

. . . features a torsion wire armature suspension system which is designed to meet a high level of vibration immunity, according to a new literature piece just made available. The bulletin provides references showing many combinations of mountings, header terminals, and contact ratings. Source: **Union Switch & Signal Div., Westinghouse Air Brake Co., 56 Switch Bldg., Swissvale, Pa.**

Underground sprinkler system

. . . brochure shows, in 10 steps, how you can install a complete system in as few as 3½ hours. A scaled graph sheet is included together with templates showing the coverage of underground sprinkler heads at various pressures. Also, sufficient engineering data is contained to help you to achieve the coverage and volume desired at available pressures. Typical installations for various sizes and shapes of yards are also shown. Source: **Rain Jet Corp., 301 S. Flower St., Burbank, Calif.**

New tank-truck pump

. . . is presented in four-page Folder F-4171, featuring the Series 3600 pump. One illustration is of a cutaway model of the pump, pointing out advanced features. Construction and weights are given, as is information on a new model for bulk plant operations. Source: **Roper Hydraulics, Inc., Commerce, Ga.**

Simple talk about a simple flowmeter

. . . is the topic of new Catalog Sheet CM-47 just issued. It discusses, in elementary terms, the new Vortex-Vel principle of fluid-flow measurement and the operation of Whirl-Flo flowmeters based on this principle. Source: **Rotron Controls Corp., Woodstock, N. Y.**

S. E. HUEY & CO.
ENGINEERS & SURVEYORS
OUACHITA BANK BLDG.
MONROE, LA.
SURVEYING & MAPPING
PIPE LINE SURVEYS

▶▶▶ Equipment Men Notes

Midwest Piping Co. opens

. . . a sales office in Pittsburgh's Park Building. In charge of the office is William M. Bushman. The office is headquarters for the sales territory which includes the Pittsburgh area, western Pennsylvania, West Virginia, and southwestern Ohio.

R. W. Kerr resigns as president

. . . and director of Fairbanks, Morse & Co. to become president of Fluor Products Co., a division of Fluor Corp., Ltd. He was also elected vice president and a member of Fluor's board of directors. From 1938 to 1948 Kerr was employed by Plomb Tool Co., starting as credit manager and advancing to executive vice president. He moved to Bingham-Herbrand Corp. as vice president and general manager of the Herbrand Division, and was elected corporation president in 1950.

His next assignment was at American Machine & Foundry Co., where he was a vice president and group executive between 1954 and 1959. Fairbanks Whitney Corp. hired Kerr as vice president, then elevated him to the presidency of Fairbanks, Morse, a subsidiary of the parent company.

Cal-Metal Pipe is contracted

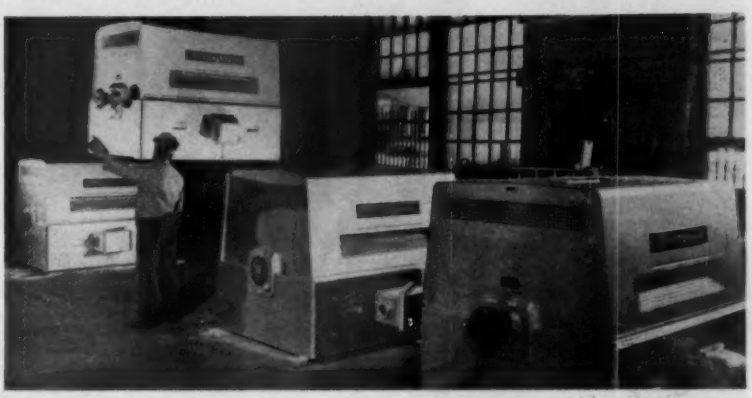
. . . to manufacture 40 miles of 8⅝-in. o.d. by 0.188-in. wall Grade B steel line pipe for Rocky Mountain Natural Gas Co., Inc. The announcement comes from R. C. Stewart, executive vice president of the Baton Rouge, La. corporation.

H. C. Price Co., Bartlesville, Okla., will install the pipe for Rocky Mountain. It will be part of the company's gathering and transmission system for their Uncompahgre Valley project in Colorado.

Clark Bros. Co. announces

. . . three appointments in its Houston and Los Angeles district offices. John W. Jennings, former application engineer at Houston, has been promoted to sales representative—small engines for the same district. He has served with the Clark organization since 1957.

John L. Spencer takes over as application engineer in the Houston district office, reporting to J. Y. Allen, district manager. He joined the company as associate engineer last year.



Westinghouse ships 24 motors to Mid-America Pipe Line Co.

. . . to pump butane, propane, and natural gas through a pipeline originating in the West Texas-New Mexico production area and extending to the South St. Paul, Minn., and Janesville, Wis., areas. The motors are F/A (fully accessible).

All of the motors—15 rated at 600 hp., six at 700 hp., and three at 1,000 hp.—are two-pole 3,600-r.p.m. machines equipped with Thermalastic insulation. They use 2,300-volt three-phase 60-cycle power and are classed outdoor weather-protected NEMA Type I.

James O. Campbell, previously application engineer, turbo marketing department in Olean, N. Y., has been transferred to the Los Angeles district office as an application engineer. He has been with Clark 3 years.

Oil Center Tool Co. realigns

. . . two top-level administrative positions. Charles T. Jones has been named general manager and A. C. (Bus) West, Jr., has become sales manager. Jones' new responsibilities will be in addition to those of vice president. He previously served as vice president and sales manager. West formerly held the post of western region sales manager.

C. T. Jones

A. C. West, Jr.

Jones has been associated with O-C-T since 1947. In 1952 he was named manager of the West Texas-New Mexico district and promoted to assistant sales manager in 1957.

West had served as western region sales manager since 1958, 8 years after joining O-C-T. He was a sales representative and manager of the West Texas-New Mexico district before heading the firm's western region.

T. E. (Travis) Parish is named

T. E. Parish

. . . assistant to the general manager of Hughes Tool Co., M. E. Montrose, senior vice president and general manager, announces. Parish will represent management on special assignments and in community and industry activities and relations. Prior to this appointment, Parish was manager of finished-product inventory planning and distribution. He joined Hughes in 1937.

National Supply Co. appoints

. . . Mountain Iron & Supply Co., with headquarters in Wichita, Kans., and Parkersburg, W. Va., as a distributor for Spang welded and seamless pipe. All Spang oil-country and standard pipe products, including drill pipe and tool joints, will be handled by Mountain Iron's various sales outlets throughout the United States.

Tommy L. Nichols assumes post

. . . as sales engineer in McEvoy Co.'s Louisiana district with headquarters in Lafayette. He moves to his new assignment from the company's home offices in Houston.

Besides representing McEvoy as salesman, Nichols will provide engineering assistance to help customers solve problems in specifying wellhead equipment, gate valves, multiple-com-

ENGINEERS
GULF INTERSTATE COMPANY
1125 BRAZOS STREET
HOUSTON, TEXAS
CONSULTANTS
DESIGNERS

pletion equipment, and other products.

Nichols has been with McEvoy since 1956. During this time he spent a year in South America handling export sales in Venezuela.

At the same time, C. B. Herring was appointed sales and service representative in Laurel, Miss. He will be in charge of the company's operations in Mississippi, Alabama, and Georgia. Herring has been with the company since 1956 and formerly was located in the Houma, La., offices.

Two district managers named

... by Welex, Inc., wireline service company with headquarters in Fort Worth.

New district manager at Tyler, Tex., is Jerry Cahill, former Fort Worth sales engineer. Replacing Cahill in

Jerry Cahill

Ray Evans

Fort Worth is Ray Evans, who transferred from Welex's Research & Engineering Center in Houston. At Winfield, Kans., R. H. Mallet, Jr., former Wichita division sales engineer, has been named district manager.

Other recent transfers and promotions by Welex include: Lyle Dean Stroup, from Tyler logging operator to Shreveport engineer; W. F. Nidiffer, field engineer, from Shawnee to Pampa; George E. Wright, from Houston logging operator to Houston division engineer; and T. J. Wall, from Winfield district manager to marine assistant district manager at New Orleans.

William C. Bailey becomes

... branch manager of the newly opened Enid, Okla., office of Sauder Tank Co., Inc., of Emporia, Kans. Prior to this appointment, Bailey was Sauder's sales representative at Pratt, Kans.

Jim Lawrence is transferred

... to Houston and Jon Young goes to Denver, both as sales engineers, according to Edward W. Reif, sales manager for the Controls Division of Black, Sivalls & Bryson, Inc. Two new sales engineers have also been added to the Controls sales organization—Les Stillwell at Los Angeles and Jim Martin at Borger, Tex.

Reif also announced the appointment of Du Alaska Co., Anchorage, and Honolulu Iron Works Co., Honolulu, as manufacturer's representatives for BS&B controls, safety heads, and tank vents in Alaska and Hawaii.

The territory for Hudson Engineering Co., Birmingham, has been extended to include the entire state of Georgia for the same products.

Ernest Baccus joins HOMCO

... as a sales and service representative in East Texas with headquarters in Tyler. His background in the oil industry spans several years and includes work throughout East Texas, North Louisiana, and the Gulf Coast with Humble Oil & Refining Co., Magnolia Petroleum Co., and Delta Drilling Co.

He was formerly with National Supply Co. as a sales representative, and as a store manager and district salesman in Wichita Falls and Amarillo. Between 1948 and 1951 Baccus taught a course in drilling practices, sponsored by the American Association of Oilwell Drilling Contractors, at Kilgore Junior College. Just prior to joining Houston Oil Field Material Co., Inc., he held positions with Webster Drilling Co. in Tulsa, and D. H. Rowland in Dallas.

Schlumberger realigns three

... field managerial posts in Texas, Louisiana, and the Rocky Mountain area. C. A. Rosenthal, former southern Rocky Mountain division manager at Denver, has been reassigned to Houston and named Texas Gulf Coast division manager. Rosenthal joined Schlumberger in 1944 as a field engineer, serving in Texas and Oklahoma locations before moving to the Rocky Mountain area in 1952. He formerly headed the firm's northern Rocky Mountain division.

C. A. Rosenthal

I. L. Roberts, who formerly served as Texas Gulf Coast division manager, has been transferred to Lafayette as manager of the Louisiana Gulf Coast division. He succeeds W. J. Bowen who has joined the Schlumberger overseas organization. Roberts has been with the company since 1937, except for a tour of duty in the armed forces during World War II. He previously held several field engineering and managerial posts in Texas and Illinois.

I. L. Roberts

Adam Perez

Adam Perez has been promoted from sales manager of the Louisiana Gulf Coast division to southern Rocky Mountain division manager. He joined Schlumberger in 1945 and held assignments in numerous Louisiana locations.

Axelson opens new pump shop

... in Estevan, Canada, to specialize in pump and sucker-rod sales and service. Assigned to the store are D. R. Kortgaard, district manager, and Robert G. Waldon, field store service manager. Regional sales manager is L. E. Johnston.

OFFICERS AND DIRECTORS of the newly formed corporation, Engineering Enterprises, Inc., met recently to discuss initial plans. With headquarters in Houston and branch offices in Lafayette and New Orleans, the firm will market its product — No-Wall-Stick drill collars. Fred K. Fox developed the drill collar and is serving as president of the corporation. He noted that plans are being laid to issue licenses to allow manufacturers to produce and market the new product. Pictured, from left, are: John M. Winterbotham, Marvin Eickenroht, M. U. Broussard, R. W. Abercrombie, Fox, W. H. Skipwith, Jr., vice president and secretary; J. E. Teddlie, J. W. Lander, Jr., John C. Allred, and W. F. Wright, Jr., vice president and treasurer. Not pictured is Nick Furnace, vice president.

Model MB-2 Stewart & Stevenson 30 KW Diesel Generator Set generating power around the clock. The unit provides electric power for operation of electronic apparatus vital to human safety and communications in the Arctic.

Parker Drilling Company rig, powered with GM Model 12103 Diesel Engines. Lighting and auxiliary power are supplied by a Stewart & Stevenson oilfield Utility Unit and Rig Lighting Plant. The engines were properly equipped and modified by Stewart & Stevenson with special cooling and air intake systems.

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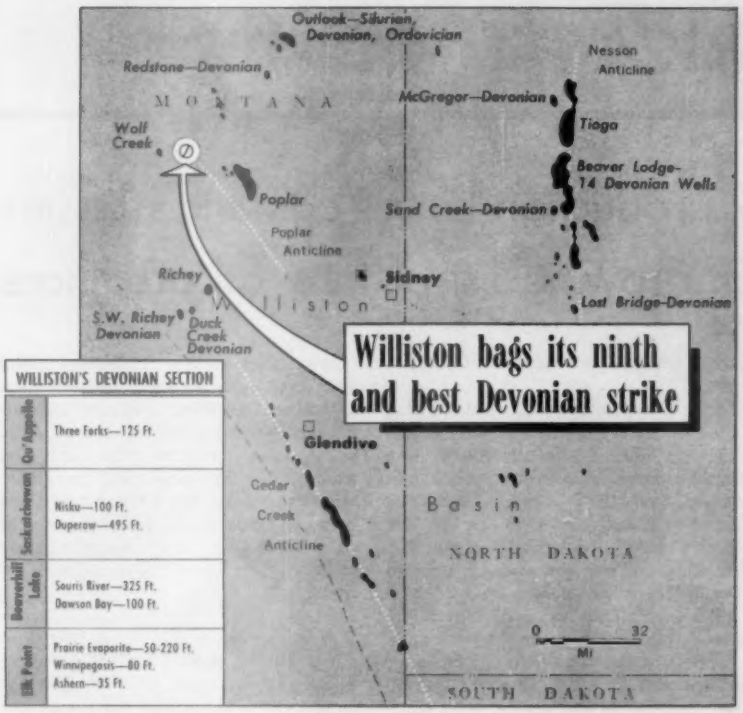


OF THE FOUR DEVONIAN rock divisions in the Williston basin, all but one hold promise of oil.

Ten-year search may be on verge of a payoff

BY JOHN C. McCASLIN

NEARLY 10 YEARS of sporadic Devonian exploration in the Williston basin has finally turned up what looks like the best oil find yet in that formation. Murphy Corp. 1 Sletvold in C SE SE 18-30n-48e, Roosevelt County, Montana, flowed 87.1 bbl. of oil hourly on a drill-stem test in the Nisku at 7,664-80 ft., commanding another look at one of the forgotten pays in Williston.

Murphy's important wildcat is located 35 miles southwest of Devonian oil at one-well Redstone field in Sheridan County, 50 miles north of Devonian production at Southwest Richey and Duck Creek fields, and 15 miles northwest of Poplar, Montana's biggest field, a Mississippian producer.

A slow start . . . After the 1951 oil find in Devonian at Amerada Petroleum Corp. 1 Iverson in Beaver Lodge field, North Dakota, there was considerable interest in the potential of these rocks as future pays for Williston. But this interest soon declined for two reasons: (1) the prolific reservoirs that were opened in Mississippian rocks throughout North Dakota's Nesson anticline and along Cedar Creek and associated structures in northeastern Montana, and (2) Devonian exploration failed to come up with anything really big.

Devonian fields in Williston are evenly divided between Montana and North Dakota. There is Devonian oil at Beaver Lodge (about 14 producers), 1 well at McGregor, 1 at Sand Creek, and 1 at Lost Bridge in North Dakota; in Montana, 1 well each at Southwest Richey, Redstone, Outlook, and Duck Creek. The big success in Mississippian exploration in Williston in recent years relegated Devonian, and, indeed, all other basin pays, to minor roles. Murphy's discovery in Montana should change all this. The Devonian is still there and its potentialities as a big oil producer are still as good as they were in 1951.

For a new pay . . . Since Beaver Lodge's first Devonian oil strike, much work has been done on nomenclature of these rocks in Williston.

Lack of adequate control hampered this work in its early days, but now Devonian stratigraphy is fairly well established and set up on the correlation charts. The Devonian is widespread throughout Williston, but in varying thicknesses and characteristics. The Devonian system here represents mostly marine sedimentation in a subsiding basin by a transgressing sea. This is quite in evidence with lower formations being progressively overlapped by younger sediments. Total thickness of the Devonian south of the forty-ninth parallel ranges from 0 to about 2,000 ft. Around the basin edge there is a widespread area of less than 300 ft. of sediments, representing a large stable shelf.

Williston Devonian rocks are divided into four groups, the Elk Point, Beaverhill Lake, Saskatchewan, and Qu'Appelle. The Winnepegosis formation is made up of small bioherms and reefoid material. There have been no oil shows in this formation on the shelf area. Widespread tectonic stability during the reef development and other factors made it a poor reservoir rock. However, the Winnipegosis in the deeper portion of the basin has had numerous oil shows and may be considered a good source rock. There have been good oil shows in Dawson Bay beds in both states, and oil is produced at Southwest Richey field from this formation. The Duperow has produced oil on the Nesson anticline. The formation has widespread porous zones and should be further tested as a good source of oil. Formations of the Qu'Appelle group have not shown as favorable reservoirs as yet.

Is typical . . . The fact that Devonian rocks have not had their fair share of exploration in Williston drilling is typical of many oil arenas. Nearly every oil basin in the business has a prime target for the drill. For Williston it has always been the Mississippian; for the Paradox, it has been the Pennsylvanian . . . until Lisbon changed the pace. We find emphasis on one rock system all over the map. But in the past couple of years there has been a noticeable trend toward the zones that were forgotten on the way down to regular pays, or to rocks on down below regular field zones. Murphy's Montana discovery should turn Williston eyes to the obvious.

WEST AFRICA

Nearby production hints Togoland's basins may join growing list of new oil provinces

BY GEORGE DE MOHRENSCHILDT

IN A RECENT ARTICLE in the Journal (July 18, p. 146) the author discussed the petroleum aspects of Ghana. Both that discussion and the following are observations resulting from his recently completed trip to Africa. To avoid repetition, Ghana is reviewed only briefly in this evaluation of West Africa. The reader should realize that comparatively little is known about this vast region. The Nigerian basin, which is productive, probably extends westward into Dahomey, Togoland, and Ghana. This affords unlimited possibilities in these countries.

Ghana became independent from the British Empire (but remains part of the British Commonwealth) some 5 years ago. It has a stable government and economically is prosperous. Togoland, a narrow country adjoining Ghana to the east, became independent from France in April this year. It used to be a German colony before World War I. Economically prosperous, Togoland seems to have the beginnings of a real democracy. Togoland is a narrow country some 350 miles long and 50-70 miles wide. Dahomey, also a French colony for some time, is to become independent in the near future. Dahomey is slightly wider than Togo, especially in its northern part.

Geology. The narrow coastal area beginning in Ghana near Accra widens gradually eastward through Togoland and Dehomey into Nigeria. This coastal area differs geologically and topographically from the large areas to the north consisting of granites and metamorphic rocks of Atacorian and Dahomevan series (Precambrian). These series are more rugged, covered with dense vegetation mostly, and present a sharp contrast to the rather accessible and flatter sedimentary coastal plain. Good north-south roads exist both in Togoland and Dahomey as well as railroads.

Outcrops can be readily examined. East-west roads follow the seashore. Tertiary deposits in the sedimentary coastal area are covered by very recent Volta, Mona, and Queme rivers. Both alluvial depositions along the deltas of coastal and alluvial deposits are being constantly laid down to the present day. Coastal deposits are about 400 ft. thick and are composed mainly of beach sands and clays interlaced with deposits of black organic matter. Alluvial deposits are somewhat thinner.

Most of the sedimentary beds seen on the surface are Continental Terminal deposits so named by the French geologists. They are divided approximately in the middle of the basin by Eocene (in Togoland), and Eocene and Cretaceous (in Dahomey).

Continental Terminal beds can be divided into upper and lower members: Upper member is composed of finer, lighter sands, mixed with montmorrillonite. In places mixtures of sand and bentonites form characteristic hard shields (see cross-section 1).

Eocene: As may be seen on the accompanying map, Eocene deposits are found in the belt trending northwest to southeast; they are composed mainly of various clays, some sands. There is a good correlation with other Eocene of Africa through microfossils. Thickness of the Eocene in Togoland is estimated at 1,000 ft. It is much thicker in Dahomey.

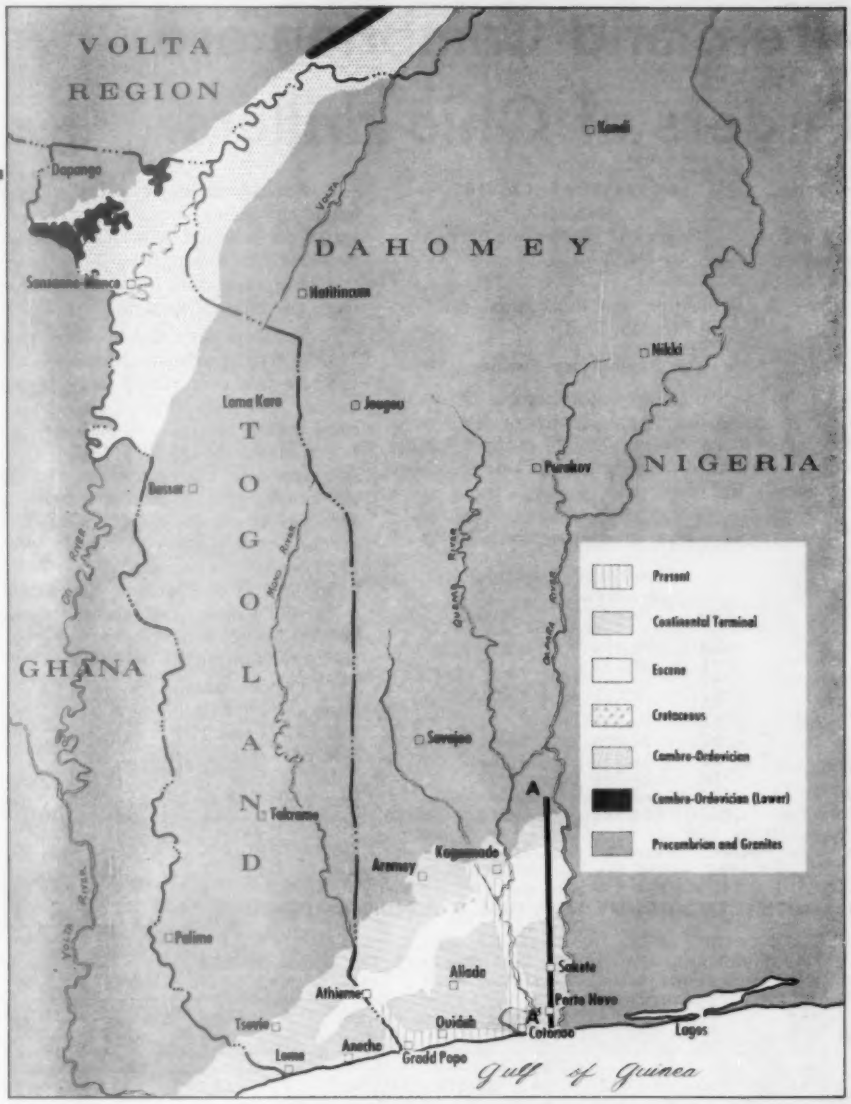
Cretaceous: Excellent outcrops are found in Dahomey, west of Zaguanado. Several wells drilled by French geologists to evaluate the section indicate marine character of deposits with excellent micropaleontological data permitting correlation with other African Cretaceous deposits and permitting subdividing of the section.

Tectonics. The general dip of the sedimentary deposits in Togoland and Dahomey is light (1°-2°) and entirely in a southerly component. Two faults have been located—one at Lahossa, another at Sehoue—and their strikes are approximately east-west with throws of about 350 ft. Smaller faults also have been located. Further geological surface work is needed to evaluate the importance of these faults and possibly reverse dips may be found. Gravimetrical and magnetic surveys made by the French geologists indicate a positive axis trending northeast-southwest and approximating Eocene-Cretaceous outcroppings on the map.

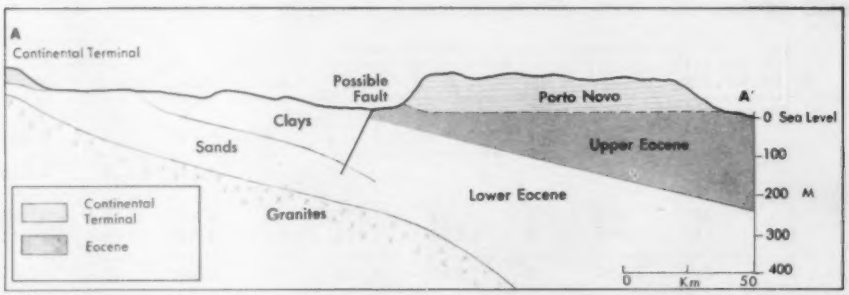
Voltaian basin. This large basin located almost entirely in the territory of Ghana is subject of a separate article. Only a very small portion of this basin is located in the northern part of Togoland and none of it is in Dahomey. This old basin is of Cambro-Ordovician age and is clearly outlined by the outcrops of various granites on the north and on the southeast by the Precambrian-Buem formation.

Stratigraphic sequence of the Voltaian basin is as follows: underneath the cover of recent deposits lie (1) Upper Voltaian (Devonian); (2) Middle and Lower Voltaian (Silurian-Ordovician); (3) basal Voltaian (Cambrian). Some shows of oil were indicated in the water wells drilled in Ghana on the edge of this basin and similarities with some North African basins were found. This writer made a preliminary survey of the Voltaian basin in 1958 but until now very little detail work was done in the basin. Returning to Togoland-Dahomey coastal basin, its oil and gas possibilities should be reviewed a little closer.

Oil and gas possibilities of West Africa. The marine characteristics of the deposits have been discussed. Some oil shows have been reported in Togoland but this writer did not see them and cannot vouch for their existence. However, since Togoland-Dahomey basin is actually an extension of the gigantic Nigerian basin it should be emphasized that this basin is already productive. Seven oil fields were dis-



MOST OF the sedimentary beds seen on the surface in Togoland are Continental Terminal deposits, so named by French geologists. They are divided near the middle of the basin by Eocene (Togoland) and Eocene and Cretaceous (Dahomey). Fig. 1.



THE NARROW coastal area begins in Ghana near Accra and widens gradually eastward through Togoland and Dahomey into Nigeria. Cross-section runs from near Porto Novo northward to Precambrian region. Fig. 2.

covered in Nigeria within the last 3 years and at end of 1959 daily production exceeded 15,000 bbl.

Only recently a pipeline was constructed and a large refinery is planned. Production is owned by Petroleum Development of Nigeria, Ltd., (Shell and British Petroleum), while Mobil Exploration of Nigeria owns exploratory rights to the areas between the producing fields and Dahomey. Main production is at Oloibiri and latest producing field was discovered at Ughalli some 80 miles west of Oloibiri.

It should be mentioned that considerable production was found in the Cameroons, Gabon, and French Equatorial Africa, along the edges of the Gulf of Guinea, south of Nigeria. Many sedimentary basins of Africa considered 15 years ago as completely unfavorable to the accumulation of hydrocarbons have been found highly productive in the last few years or are being reevaluated in view of latest discoveries.

Clinton, Berea, and Cambrian are principal targets of Ohio drillers

BY WARREN L. CALVERT
Geologist,
Division of Geological Survey,
Columbus, Ohio

THERE WERE 639 holes drilled for oil or gas in Ohio during the first 8 months of 1960. Of these, 259 were completed as oil wells for an average initial daily production of 45 bbl., and 167 were completed as gas wells for an average initial open flow of 1,647 M.c.f.d. These 426 productive wells resulted from both development and exploratory drilling and they represent a completion success of 66⅔%. Table 1 is a summary of total completions for the first 8 months of 1960, with the total initial daily oil production and total initial daily gas open flow obtained.

Exploratory Drilling

Total exploratory tests in Ohio during the first 8 months of 1960 numbered 144, or 22½% of the 639 holes drilled for petroleum. These are classified as:

1. Extensions, or tests drilled immediately outside areas of proved reserves but within 1 mile of present or previous production, total 82.

2. Outposts, tests drilled 1-2 miles from production, total 8.

3. Wildcats, tests drilled more than 2, miles from production, total 54.

Successful exploratory wells numbered 53, or 36½% of all exploratory tests drilled, and the remainder resulted in 92 dry holes. Table 2 is a summary of all exploratory tests drilled during the first 8 months of 1960, showing in each classification the number of dry holes and their total footage, and the number of gas wells with their total footage, and total initial daily open flow, and the number of oil wells with their total footage and total initial daily production.

Extensions accounted for 53% of all exploratory drilling and were 40% successful. The 21 gas extension wells had an average initial open flow of 1,076 M.c.f.d., and the 12 oil extension wells had an average initial daily production of 73 bbl. of oil. Outposts amounted to only 5% of all exploratory drilling but were 62½% suc-

TABLE 1—OHIO TOTAL COMPLETIONS* FIRST 8 MONTHS OF 1960

	Initial daily production (bbl.)		Initial daily open flow (M.c.f.)			
	Oil		Gas		Dry	Total
January	36	1,834	24	79,814	20	80
February	40	1,282	21	27,395	29	90
March	18	1,203	21	17,230	27	66
April	21	1,092	13	17,751	29	63
May	21	1,017	26	39,349	32	79
June	56	2,394	21	24,923	30	107
July	30	1,087	23	42,236	23	76
August	37	1,747	18	26,288	23	78
Total	259	11,696	167	274,986	213	639

*Ohio Oil and Gas Association figures, reclassified. Includes some wells completed before but not reported until 1960.

TABLE 2—OHIO EXPLORATORY TESTS FIRST 8 MONTHS OF 1960

	Oil			Gas			Dry		Total	
	No.	Initial daily prod., bbl.	Feet	No.	Initial open flow, M.c.f.	Feet	No.	Feet	No.	Feet
Extensions	12	875	36,942	21	22,605	63,321	49	131,691	82	231,954
Outposts	2	60	5,733	3	3,792	11,165	3	6,149	8	23,047
Wildcats	2	20	7,767	12	10,260	38,460	40	102,860	54	149,087
Total	16	955	50,442	36	36,657	112,946	92	240,700	144	404,088

TABLE 3—OHIO EXPLORATORY TESTS—EXTENSIONS—FIRST 8 MONTHS OF 1960

	Oil			Gas			Dry		Total	
Horizon	No.	Initial daily prod., bbl.	Feet	No.	Initial open flow, M.c.f.	Feet	No.	Feet	No.	Feet
Pennsylvanian:										
Shallow	...	...	...	...	...	...	8	6,236	8	6,236
Total	...	...	...	...	...	...	8	6,236	8	6,236
Mississippian:										
First Berea	1	25	953	1	32	1,030	3	4,267	5	6,250
Second Berea	1	1	1,597	2	2,250	1,698	3	3,740	6	7,035
Total	2	26	2,550	3	2,282	2,728	6	8,007	11	13,285
Devonian:										
Oriskany	...	...	...	2	3,844	4,681	2	4,911	4	9,592
Total	...	...	...	2	3,844	4,681	2	4,911	4	9,592
Silurian:										
Clinton	10	849	34,392	16	15,160	55,912	28	91,764	54	182,068
Total	10	849	34,392	16	15,160	55,912	28	91,764	54	182,068
Cambrian:										
Total	...	...	...	...	...	...	5	21,043	5	21,043
Total extensions	**12**	**875**	**36,942**	**21**	**22,605**	**63,321**	**49**	**131,961**	**82**	**232,224**

TABLE 4—OHIO EXPLORATORY TESTS—OUTPOSTS—FIRST 8 MONTHS OF 1960

Horizon	Oil			Gas			Dry		Total	
	No.	Initial daily prod., bbl.	Feet	No.	Initial open flow, M.c.f.	Feet	No.	Feet	No.	Feet
Pennsylvanian:										
Shallow	..	.....	.....	..	.....	.....	1	1,395	1	1,395
Total	..	.....	.....	..	.....	.....	1	1,395	1	1,395
Mississippian:										
First Berea	..	.....	.....	..	.....	.....	1	1,180	1	1,180
Second Berea	..	.....	.....	..	.....	.....	..	.....	..	.....
Total	..	.....	.....	..	.....	.....	1	1,180	1	1,180
Silurian:										
Clinton	2	60	5,733	3	3,792	11,165	..	.....	5	16,898
Total	2	60	5,733	3	3,792	11,165	..	.....	5	16,898
Cambrian:										
Total	..	.....	.....	..	.....	.....	1	3,574	1	3,574
Total outposts	**2**	**60**	**5,733**	**3**	**3,792**	**11,165**	**3**	**6,149**	**8**	**23,047**

cessful, resulting in three gas wells with an average initial daily open flow of 1,264 M.c.f., and two oil wells which averaged 30 bbl. of oil per day initially. Wildcats were 26% successful.

The 12 successful wildcat gas wells were completed for an average initial daily open flow of 790 M.c.f., and the two successful wildcat oil wells had an average initial daily production of 20 bbl. Total exploratory footage drilled amounted to 404,088 ft.

Horizons to which the various classifications of exploratory tests were drilled in Ohio during the first 8 months of 1960 are summarized in Tables 3, 4, and 5. It is significant that 55% of all exploratory wells were drilled to the Clinton sand, 17% to the Berea sand, and 10% to the Cambrian dolomites.

Important Developments

No important shallow Pennsylvanian drilling took place in Ohio during the first 8 months of 1960. Twelve exploratory dry holes were drilled.

Mississippian exploratory drilling resulted in two important wildcat gas discoveries and one important oil extension, as follows:

- Bailey 1 Hendricks, in Section 32 of Salisbury Township, Meigs County, TD 1,580 ft., discovered the Middleport gas pool in the second Berea sand, 1,526 to 1,537 ft. Completed 8-25-60, IOF 133 M.c.f.d. after fracture. IRP 540 psi.
- O. F. G. 1 Godwin, in Section 18 of Green Township, Wayne County, TD 690 ft., a shallow wildcat in a Clinton sand pool, was completed 5-20-60 in the Berea sand, 670 to 690 ft., for an IOF of 481 M.c.f.d. natural, IRP 212 psi.
- K. Drilling Co. 1 Good, in Section 36 of Madison Township, Vinton County, TD 953 ft., a south extension to the abandoned Zaleski oil pool, was completed 8-8-60 in the Berea sand 947 to 953 ft., IP 25 BOPD, flowing after fracture.

Several gas extensions and 18 dry holes were drilled in this category. Water flooding of the Berea sand in Chatham Township, Medina County, and in Perry Township, Ashland County, continued active and successful.

Devonian exploratory drilling discovered a new Oriskany sand gas pool,

TABLE 5—OHIO EXPLORATORY TESTS—WILDCATS—FIRST 8 MONTHS OF 1960

Horizon	Oil			Gas			Dry		Total	
	No.	Initial daily prod., bbl.	Feet	No.	Initial open flow, M.c.f.	Feet	No.	Feet	No.	Feet
Pennsylvanian:										
Shellow	..	.....	.....	..	.....	.....	3	1,300	3	1,300
Total	..	.....	.....	..	.....	.....	3	1,300	3	1,300
Mississippian:										
First Berea	..	.....	.....	1	481	690	9	7,881	10	8,571
Second Berea	..	.....	.....	1	133	1,580	2	2,678	3	4,258
Total	..	.....	.....	2	614	2,270	11	10,559	13	12,829
Devonian:										
Oriskany	..	.....	.....	1	1,650	2,365	..	.....	1	2,365
Total	..	.....	.....	1	1,650	2,365	..	.....	1	2,365
Silurian:										
Newburg	..	.....	.....	3	1,379	8,308	..	.....	3	8,308
Clinton	1	10	4,439	5	6,198	19,804	14	53,570	20	77,813
Total	1	10	4,439	8	7,517	28,112	14	53,570	23	86,121
Ordovician:										
Trenton	..	.....	.....	..	.....	.....	2	2,796	2	2,796
Other Ordovician	..	.....	.....	..	.....	.....	2	3,557	2	3,557
Total	..	.....	.....	..	.....	.....	4	6,353	4	6,353
Cambrian:										
Total	1	10	3,328	1	419	5,713	7	27,613	9	36,654
Precambrian:										
Total	..	.....	.....	..	.....	.....	1	3,465	1	3,465
Total wildcats	**2**	**20**	**7,767**	**12**	**10,260**	**38,460**	**40**	**102,860**	**54**	**149,087**

Permit	County	Township	Section	Operator, No. and farm	Date completed	Total depth	Formation reached	Classification
1762	Ashland	Lake	2	Stewart 1 Mosher	2- 4-60	5,485	Trempealeau	Deep pool WC
1784	Ashland	Ruggles	L-14	Dalton & Hanna 1 Eshtruth	4-28-60	*4,451	Trempealeau	Deep pool WC
2	Butler	Wayne	6	Continental 1 Crist	1-15-60	2,933	Eau Claire	Wildcat
3	Clermont	Stone Lick	L-681	Continental 1 Wikoff	7- 3-60	3,435	Mt. Simon	Wildcat
7	Clinton	Wayne	S-808	Kewanee 1 McVey	3-27-60	3,465	Precambrian	Wildcat
2	Delaware	Porter	L-16	Monk 1 Thurston	3-25-60	†3,739	Trempealeau	Extension
4	Delaware	Porter	L-27	McBride 1 Kenny	8-30-60	‡3,644	Trempealeau	Outpost
287	Fairfield	Violet	8	Graber 1 Fisher	5-20-60	§3,328	Trempealeau	Wildcat
1256	Medina	Hinckley	L-52	Wiser 2 Divoky	8-29-60	§6,008	Trempealeau	Extension
1265	Medina	Westfield	L-14	Porter 3 Fee	7-19-60	5,431	Trempealeau	Deep pool WC
4	Morrow	Bennington	21	Lynn 1 Myser	3-28-60	3,878	Trempealeau	Extension
7	Morrow	Bennington	21	Monk 3 Monk	8-12-60	3,774	Trempealeau	Extension
5	Morrow	Bennington	L-36	Wehmeyer 1-A Fuller	4-23-60	3,574	Trempealeau	Outpost
7	Warren	Clear Creek	4	Continental 1 Sellers	4-28-60	2,933	Eau Claire	Wildcat
8	Warren	Washington	L-1,523	Continental 1 Kitteridge	5-23-60	2,945	Eau Claire	Wildcat
1094	Wayne	Canaan	36	Obermiller 1 Henderlong	8-25-60	§5,713	Trempealeau	Deep pool WC

*Producing depth: 31,000 at 4,420 ft. †Producing depth: SO 3,620-37 ft. ‡Producing depth: SO 3,547-54 ft. §Producing depth unknown.

in addition to extending two other Oriskany sand gas pools during the first 8 months of 1960, all in Ashtabula County. Two Oriskany extensions were dry.

The new wildcat discovery:

• Felmont Oil Corp. 1 Hudson, Lot 22, Pierpont Township, Ashtabula County, TD 2,365 ft., discovery well of Pierpont Oriskany gas pool, completed 2-29-60 in the Oriskany sand, 2,360 to 2,365 ft. IOF 1,650 M.c.f.d., natural, with IRP 953 psi. A subsequent extension, the Felmont 1 Clary, TD 2,364 ft., was completed 5-4-60, IOF 3,285 M.c.f.d., natural, IRP 935 psi.

Silurian wildcat exploratory drilling accounted for three Newburg dolomite gas discoveries in old Clinton sand pools, five Clinton sand wildcat gas successes, and one small Clinton sand wildcat old discovery. Important among these are:

• H. L. Starr 1 K. Miller, Section 30, Walnut Township, Gallia County, TD 3,352 ft., discovery well of Waterloo pool, completed 8-11-60 in the Clinton sand, 3,320 to 3,350 ft. IOF 2,400 M.c.f.d. after fracture. IRP 638 psi.

• Walsmith 1 Walsmith-Kinsel, Section 30, Pike Township, Perry County, TD 3,232 ft., completed 4,24-60 in the Clinton sand, 3,220 to 3,232 ft. IOF 3,100 M.c.f.d. IRP 1,080 psi.

Successful Clinton outposts numbered 2 oil and 3 gas, while 10 oil extensions and 16 gas extensions were completed. Active areas of Clinton sand gas development were shown by:

1. Continued drilling in Bushnell gas pool, Monroe Township, Ashtabula County, with northward extension into Conneaut Township.
2. Additional development of Creola gas pool, Swan Township, Vinton County.
3. Considerable drilling activity in Canaan Township, Wayne County.

Active areas of successful Clinton oil development were principally indicated by:

1. Concentrated drilling and extension of North Logan oil pool in Marion Township, Hocking County.
2. Completions in Fallsburg oil pool of Fallsburg Township, Licking County.

Also, the active development of a Clinton sand gas-storage area in Jackson Township, Stark County took place during the first 8 months of 1960.

Ordovician exploratory drilling was confined to four wildcat dry holes during the first 8 months of 1960. Two of these were to the Trenton formation, one was a Black River limestone test, and the other stopped in the Oneota formation.

Cambrian exploratory tests numbered 16, one of which penetrated the Precambrian metamorphics, and these are summarized in Table 6. Six were rank wildcats, of which five were dry holes and one was successfully completed as a small oil well. Three deeper pool wildcats were unsuccessful, but one was completed as a good gas well. Four extension and two outpost tests were dry. The two successful Cambrian tests completed during the first 8 months of 1960 are:

1. Graber 1 Fisher, Section 8 of Violet Township, Fairfield County, a much-publicized well which was completed in May 1960 for 10 BOPD and 120 BW after acid and fracture treatment in the Trempealeau dolomite, and which was making approximately 3 BOPD and 100 BW 4 months after completion.

2. Obermiller 1 Henderlong, Section 36 of Canaan Township, Wayne County, was completed in August 1960, in the Trempealeau dolomite for an initial daily open flow of 419 M.c.f.d. natural, with an initial rock pressure of 2,065 psi. This well is delivering exceptionally well into the line. It is about 25 miles southwest of the good Trempealeau gas well in Hinckley Township, Medina County.

Summary

During the first 8 months of 1960, 66⅔% of all holes drilled in Ohio were productive. Development wells accounted for 77½% of all drilling, while exploratory tests amounted to 22½%, and of these latter, 36½% were successful. Principal activity involved the Clinton sand (Silurian), the Berea sand (Mississippian) and the Cambrian dolomites and sands.

Deep Arkoma play remains active with four wells

There are four active wells in the highly important deep producing area of Norris pool on the Brazil anticline of Latimer County in southeastern Oklahoma's Arkoma basin.

The deep play opened earlier this year when Midwest Oil Corp. finished 1 Orr in S½ SW 8-6n-22e. That well flowed 11,700 M.c.f.d. on ½-in. choke from Red Oak Pennsylvanian perforations at 7,193-7,330 ft. From the Spiro sand at 11,514-68 ft. the well flowed 17,847 M.c.f.d. Reserves of this well are estimated at about 80 billion cubic feet of gas.

At 1 Foster, the confirmation well in W½ NW SE 7, Midwest is cleaning out below 8,150 ft. Total depth is 11,832 ft. This well flowed from 15-20 M.M.c.f.d. from Red Oak at 7,747 ft. The Spiro made 2,500 M.c.f.d. at 11,712 ft. Midwest is also drilling below 10,900 ft. at 1 Lyons in SE NW SW 9. Good gas flows from Red Oak are reported at this well. The 1 Rider, NW NW SE 17, is drilling below 1,243 ft. Frankfort Oil Co. has stuck pipe at 1 Hulsey unit in NW NW SE 18. Total depth is 6,298 ft.

McIntosh County. Tidewater Oil Co. will drill to about 2,500 ft. at a new wildcat in this southeastern Oklahoma county. The well is 1 W. L. Suiter, C SE NE 1-10n-17e. It will be a stepout and confirmation test for new Southeast Checotah pool. Location is 2 miles southeast of 1 Sizemore-Winkel in SE SW 25-11n-17e. That well flowed 2,500 M.c.f.d. from Georges Fork sand at 1,110-23 ft.

Sequoyah County. Stephens Production Co. dually completed 4 Redland Ranch in SE NE SW 26-10n-25e, Redland pool. The well flowed 6 M.M.c.f.d. from Hale sand at 6,547-49 and 6,550-54 ft. From Spiro it flowed 500 M.c.f.d. at 6,140-46 ft.

Texas workover well becomes gas discovery

A workover project in northeastern Jack Herbert-Strawn field, west-central Upton County, West Texas, is an indicated Fusselman gas-condensate discovery.

The successful well is Texaco Inc. 1 J. H. Graft, NCT-1, Section 102, Block D, CCSD&RGNG Survey, 16 miles northwest of Rankin. The well flowed 6 bbl. of condensate in 5 hours and 4,900 M.c.f.d. from perforations at 11,676-11,749 ft. This well was first a Strawn gas-condensate discovery 7 years ago, making 544 bbl. of condensate and 6,600 M.c.f.d. through 20/64-in. choke.

Winkler discoveries. Two old Ellenburger wells in Winkler County have been completed by Humble Oil & Refining Co. as new-pay discoveries in the Waddell. The 2 Brown & Altman Gas unit 1, completed last year as a gasser in Emperor-Ellenburger field, flowed 31 bbl. of 480°-gravity oil daily on test of perforations at 11,158-78 ft. Flow was on ⅜-in. choke. This well is in Section 16, Block B-5, PSL Survey, 6 miles south of Kermit.

The second new producer, 5-B McCutchen, an old Ellenburger well in Keystone field, is now producing from Waddell at 2,960-70 and 9,325-35 ft. The well flowed 50 bbl. of 39.8°-gravity oil daily through 26/64-in. choke. Location is in Section 15, Block B-2, PSL Survey, 5½ miles northeast of Kermit.

Tenth annual RMAAPG meeting coverage ready

The Rocky Mountain Section of the AAPG has released the 1960 Geological Record of its tenth annual meeting held last winter in Billings. This record contains complete papers of 17 papers given at the meeting plus abstracts of 14 others. The book may be obtained from Petroleum Information, 1640 Grant Street, Denver, or from their Casper, Billings, Durango, and Bismark offices.

North Texas' Ashley field is confirmed in Jones

A Jones County field was confirmed last week by Fletcher Oil & Drilling Corp. The 2 Billy Ashley, 4 miles northwest of Noodle, flowed 89 bbl. of oil per day on 22/64-in. choke from perforations in the Canyon sand at 3,871-81 ft., confirming the 1 well which opened Ashley field. Location is in Subdivision 218, M. W. Dikes Survey, 218.

Knox County. Paragon Corp. completed 1 Frank Knapp to open a new producing area 3½ miles north of Munday in Plumlee. Second Tannehill field, Knox County. The well pumped 151 bbl. of 40°-gravity oil plus 40% water per day from the Tannehill "A" sand. New field will be called McCullough Tannehill "A" sand field. Location is in Section 3, D. G. Burnett Survey 16. Nearest oil is 1 mile south at Faye Tannehill field. Perforations are at 1,913-14 ft.

Potential test due at Bone Spring discovery

Potential test is being made at a Bone Spring discovery in southwestern Lea County, 15 miles southwest of Monument in Southeast New Mexico.

Discovery well is Ohio Oil Co. 1 Lea unit, 14,735-ft. wildcat. Last gage reported was 95 bbl. of oil in 11 hours from perforations at 9,448-9,550 ft. This is a new pay for the well which was originally completed in July 1959 in Devonian at 14,347-14,489 ft. From that zone the well flowed 516 bbl. of oil and 9 bbl. of water per day on 8/64-in. choke. Location is 2½ miles southwest of shallow Peral-Queen field in 12-20s-34e.

Coke County, Texas gets new Canyon sand discovery

Canyon sand discovery was opened at a wildcat in northwestern Coke County, West Central Texas. New producers is Coastal States Gas Producing Co. 1 J. B. Walker, W. R. Walker Survey 18, A-1828.

The well, 5 miles south of Silver townsite, flowed 156 bbl. of oil per day through 20/64-in. choke from perforations at 5,593-97 ft. Well is located ¾ mile southwest of Bloodworth Strawn sand field. Gas was also recovered on a drill-stem test of the Strawn lime at 6,421-59 ft.

Green River adds Blair

The first production from Blair in Wyoming's Green River basin is official. Discovery well is Mountain Fuel Supply Co. 1 Jackknife Spring unit in SW NW 11-16n-101w, Sweetwater County.

The well flowed 7,220 M.c.f.d. from Blair Mesaverde perforations at 5,335 to 6,336 ft. Location is 9 miles southwest of Almond gas at Sand Butte field.

Ohio well taps Clinton

In Ohio, natural production of 8,320 M.c.f.d. in the Clinton sand was gaged on completion of Ohio Fuel Gas Co. 3 Lime Material Co., 3 Qr., Perry Township, Muskingum County. The pay in this southeast extension of Bridgeville pool was from 3,965 to 3,994 ft. with a rock of 910 psi.

Chas. Kuhn reports another producer in the Millbrook play in southeast Plain Township, Wayne County. The 2 Clark Shriver, Section 36, after fracture tested 3,250 M.c.f.d. of gas and 40 bbl. of oil. The Clinton was logged at 3,040-77 ft., and had 281 M.c.f.d. of gas and a showing of oil natural.

Deep tests. East Ohio Gas Co. has launched a wildcat in Townsend Township, Sandusky County, drilling at 149 ft. on 1 V. & I. Haaf, Section 33. In Mary Ann Township, Licking County, Lake Shore Pipeline Co. is ready to go on 1 Lucille P. Crowley, Lot 15.

Wildcat is producer in Texas' Lee County

AFTER long testing, commercial oil production seems assured for Union Producing Co.'s rank wildcat in southern Lee County, South Central Texas.

From what could be Edwards lime, with perforations at 8,095-8,105 ft., and 8,113-99 ft., the prospective discovery well, 1 Preuss, flowed 10.11 bbl. of 37.5°-gravity oil in a 1¼-hour initial drill-stem test through ¼-in. choke.

A later test, opened 5 hours, flowed 22.92 bbl., or at the rate of 22.92 bbl. per day. Gas oil ratio on the initial test was 361 cu. ft. per bbl. In the later test it was 636 cu. ft. per bbl.

The well is plugged back to 8,258 ft. from a drilled depth of 12,246 ft. after a series of tests in the lower where 45 ft. of condensate and 225 horizons. Most significant of the deeper tests was at 10,802-18 ft., ft. of condensate-cut mud was recovered.

Location of the well is just south of Giddings. Nearest production is at Tanglewood, in the extreme northern corner of the county, and at Pietsch, about the same distance south, in northern Fayette County.

At Tanglewood, there has been only one well, drilled by Humble Oil & Refining Co. in 1948. It was productive of 34.6°-gravity oil from Edwards lime at 6,302-41 ft. At Pietsch there is a small Midway gas well drilled in 1947.

Only other production in Lee County has been at McDade, about 15 miles northwest of Union's new discovery.

Canada's Fort Nelson area is big new gas frontier

FORT NELSON, B. C., was a far-northern outpost only a comparatively few months ago, but the fabulous gas-discovery ratio that added billions upon billions of cubic feet of natural gas to the province's reserves in 1959 has made the name a byword in petroleum circles of western Canada. That was last drilling season, and with a new winter drilling season almost upon us the exploration play of 1959 will be dwarfed by the program now being brought into shape. If the extremely high discovery ratio that saw the Kotcho Lake and Petitot River regions become significant gas-supply possibilities can be maintained this drilling season a pipeline into the area in 1961 is inevitable.

Rig shortage . . . The exploration play scheduled to start as soon as the frost firms up the ground already has resulted in a rig shortage in the area, and a slight loosening of the strings on budgets will spur additional activity. North from Fort Nelson at least 13 significant wildcat tests have already been staked; in addition two others will be drilled immediately southeast of this focal point. This northern outpost was bulging at the seams with last year's activity and as the 1960-61 program swings into high gear accommodation will be even harder pressed.

Evaluation due. The forthcoming drilling program will be designed to evaluate large spreads of company holdings. Some idea of the far-reaching extent of the planned programs can be seen when it is considered that 14 separate British Columbia permit tracts will be drilled stretching from the Alberta-B. C. border 122 miles northeast of Fort Nelson to the B. C.-Northwest Territories boundary 100 miles north of the hot spot. There will be six separate operators involved in the B. C. play designed primarily for the discovery of new gas reserves. Add to this impressive total of wildcats for B. C. the drilling program already under way by Shell Oil just north of the Alberta-B. C. boundary in the Northwest Territories, as well as drilling programs for Home Oil & Associates at Celebita Lake and wells for Atlantic Refining Co. and Pan American Petroleum Corp. in the southern part of the territories and the total known exploratory tests within a radius of 150 miles of Fort Nelson climbs to over 20.

Active firms. A look at operations by operating company reveals that Pan American Petroleum Corp. and Western Natural Gas Co. each have five locations firmed up in northeast British Columbia. Pacific Petroleums, Ltd., will be pushing tools at two wildcats in this general area, while Atlantic Refining Co., Texaco Exploration Co., and Tennessee Gas Transmission Co. will each be operating on at least one exploratory test as soon as the frost really thickens. There are also possibilities that Mobil Oil of Canada, Ltd., and other unnamed companies will be pushing down holes in this region early this winter.

Pan American's drilling program that will see at least five rank wildcats drilled almost immediately will include single tests on Permits 309, 903, 322, and 1,159, as well as a venture on Drilling Reservation 15. Western Natural Gas has okayed drilling on Permits 195, 144, 310, 311, and 382. The Pacific Petroleum-operated wells will go down on Permit 359 and Drilling Reservation No. 17, while Texaco Exploration will be pushing tools at a well on Permit No. 106 and Tennessee Gas Transmission will be operator of a wildcat on Permit 956. This drilling program could quite easily rewrite the record books of western Canada for the region has one of the highest potentials of this vast region.

Plans are already well advanced for construction of gas-transmission facilities into the area and along with this record-setting exploratory program a number of development wells in previous discovery areas will also be punched down this winter. The hoped-for results would assure construction of gas pickup lines and spark a new round of applications for additional gas export.

East Texas' Jurassic stretches northwest into Hunt County

JURASSIC production in East Texas has been extended to Hunt County, on the far northwest rim of the basin along the Mexia-Talco fault system.

The new discovery, the first Jurassic production in Hunt County, is the second for East Texas within a month. It opens the eighteenth field in the district to produce from the Jurassic.

The Hunt discovery is by Paul Teas at his 1 Chambliss, in the Mary Latham Survey, 4 miles northeast of Quinlan.

Discovery well is rated good for 23 M.M.c.f.d. of gas with 32 bbl. of 61.6°-gravity condensate per M. M.c.f. Pay is in the Smackover section, perforated at 8,978-98 ft., in hole drilled to 9,100 ft. The well is shut in with pressure of 2,937 psi.

The new field is more than 20 miles from nearest other Jurassic production, located basinward (eastward) at Ginger in Rains County. Around the basin's rimming Mexia-Talco fault system, the nearest Jurassic production is at Sulphur Bluff in Hopkins County, more than 40 miles northeast.

The discovery follows one late last month by Sunray Mid-Continent Oil Co. in Cass County, more than 95 miles east on the opposite side of the basin near the Louisiana line.

Sunray Mid-Continent's discovery well, 1 Grogan Minerals, at Bivins, was oil-productive with pay in the Cotton Valley member of the Jurassic, perforated at 10,327-44 ft.

Since completion of the Hunt County discovery well, R. W. Scott has started another Smackover test in the same general area. Location, at 1 Wheeler, in the James Hamilton Survey, is 1½ miles north of Quinlan, placing it about 3 miles southwest of the Teas discovery.

Another Jurassic test also is getting started in Cass County with location about 4 miles southwest of Sunray Mid-Continent's discovery. Location is in the Nebbish area, 1½ miles southwest of Kildare. It is a joint operation of Sklar Producing Co., Sunray Mid-Continent, and J. R. Butler. Projected depth of 12,000 ft. should give a look at the Smackover horizon.

Utah well has dual production

Dual production from both Mississippian and Devonian is reported at Belco Petroleum Co. 2 Belco-State in C NE NE 16-30s-24e, Lisbon field, San Juan County, Utah.

The well flowed 461 bbl. of oil per day through 19/64-in. choke from Mississippian perforations at 8,548-8,661 ft. Flow from lower Mississippian and top of Ouray Devonian at 8,697-8,727 ft. was 68 bbl. per day on ½-in choke. Location is 1 mile southwest of the Devonian discovery at Lisbon field.

Pennsylvania city gets gas well

IN PENNSYLVANIA, a gas well was completed in the city of Dubois. It is an extension to Boone Mountain pool. Operator completed for an open flow of 1,262 M.c.f.d. after fracturing.

Two wells were also completed in Rockton pool. The Old Town Beagle Club well extended this pool to the southwest. Open flow was 1,958 M.c.f.d. after fracturing with a little salt water. The second well completed in this pool was John Potter 2, drilled by New York State Natural Gas Co. This is one of the largest in the pool with an open flow of 30,370 M.c.f.d. after fracture. Rock pressure was 3,342 psi. in 56 hours. All of the above wells were drilled in Clearfield County in the Punxsutawney - Driftwood field where the Onondaga chert and Oriskany sand interval is producing.

Washington County. The wildcat in this county being drilled by Benedum-Trees was plugged and abandoned. This well found 1 M.M.c.f.d. in the Helderberg but after fracturing made only 170 M.c.f.d. and had 1,000 ft. of salt water in the hole in 12 hours. A second wildcat was plugged at 5,850 ft. after losing a string of tools, wireline, bailer, and other equipment in the hole. Before the fishing job, the well had found 300 M.c.f.d. in the Red Medina. This was the Frank Kapp well by Bierg and Johnston in Warren County.

A third wildcat was a disposal well drilled by J&L Steel Co. on their own land in Beaver County. The well was completed after coring the Oriskany. The cored interval was from 5,250 ft. to 5,277 ft., 5,340 ft. to 5,399 ft., and 5,403 ft. to 5,427 ft. The Onondaga limestone was topped at 5,225 ft., the Oriskany at 5,387 ft.

Considerable salt water was found in the Oriskany and a show of gas in the lower part of the Onondaga. Waste from the steel company is to be disposed of under pressure into the Oriskany. Before completion, the well was fractured.

Leidy field. Phillips Petroleum Co. brought in the largest well to date in the Ole Bull pool of Leidy field when gas was discovered in the Oriskany. This field in Potter County made 5 M.M.c.f.d., natural. Operations are still under way.

East Texas' Quitman has triple completion

A new triple-zone well completed by Shell Oil Co. in the Quitman field, of Wood County, East Texas, has a total flow rating of 1,073 bbl. of oil daily through chokes.

All three zones produce from the Rodessa section. One, the shallowest, perforated at 8,289-99 ft., opens a new pay, the Gloyd "W1" sand. It flowed 312 bbl. of 40.7°-gravity oil daily through ¼-in. choke with a gas-oil ratio of 455 cu. ft. per bbl.

Other zones are the Lower Rodessa and Kirkland sands. The former, perforated at 8,445-55 ft., flowed 296 bbl. of 43.3°-gravity oil daily through ¼-in. choke with ratio of 922 cu. ft. per bbl. Kirkland sand flowed 465 bbl. of 45.5°-gravity oil daily through 14/64-in. choke with ratio of 522 cu. ft. per bbl.

The well is Shell's 8 B. L. Johnson, in the Joshua Thomas Survey.

Discovery wells

INDIANA

Dubois County:

Amity Oil Corp. 1 Jas. Hochgesand, SE SE SE 6-2s-5w. IP 12 BOPD, 6 BWPD, Aux Vases 83-837 ft. TD 837 ft. Opens North Duff pool.

Phillips Rusher 1 Allen Werne, NE SW NE 35-3s-4w. IP 4 M.M.c.f.d., Tar Springs 331-360 ft. TD 569 ft. Opens East Ferdinand pool.

Spencer County:

James Monroe 1 Helmer-Berry Feed Corp., NW NW 35-7s-6w. IP 17 M.M.c.f.d., Penn. 540-553 ft. TD 558 ft. Opens North Africa pool.

KANSAS

Chatauqua County:

Pure Oil Co. 2 MKO Coach Lines, SW SE SE 10-32s-8e. IPF 4 M.M.c.f.d., Layton 1,758-62 ft. TD 1,889 ft.

Hamilton County:

Hamilton Brothers 1-5 J. B. Owings, C SW NE 5-24s-41w. IPF 2,636 M.c.f.d., 96 BWPD, Winfield 2,292-98, 2,286-88, 2,262-64, 2,252-56, 2,240-42 ft. TD 2,315 ft.

Hodgeman County:

Colorado Oil & Gas Co. 1 Antrim, C SE NW 18-21s-22w. IP 130 BOPD, 36°, Miss. 4,370-86 ft. TD 4,668 ft.

Kingman County:

Drillers Production Co. 1 Opdyke, C SW¼ 28-27s-5w. IP 82 BOPD, 5% bw. Miss. 3,769-86 ft. TD 3,786 ft.

Pickrell Drilling Co. 1 Kostner, SE SE SE 14-29s-7w. IP 120 BOPD, 20% bw. 39°, Lansing-Kansas City 3,764-69 ft. TD 4,520 ft. Opens Northeast Basil pool.

Petroleum, Inc. 1 Early "C," 28-29s-6w. IP 280 BOPD, 2% bw. 44°, 4,494-97 ft. TD 4-560 ft.

Marion County:

Can-Am 1 Stenzel, NE NE NW 14-19s-3e. IP 32 BOPD, 70% bw., 37.1°, Miss. 2,424-79 ft. TD 2,479 ft. Open Southwest Klenda field.

McPherson County:

George R. Hess 1 Miller, SE SE SE 27-18s-2w. IP 36 BOPD, 120 bw., 35°, Miss. 2,934-46 ft. TD 2,946 ft. Opens North Larson pool.

Rooks County:

Imperial Oil Co. of Kansas 1 LeSage, 18-7s-20w. IP 241 BOPD, 37°, Lansing-Kansas City 3,348-92 ft. TD 3,630 ft. Opens Le Sage pool.

Tomlinson-Kathol 1 Lynd, SW SE SW 32-9s-19w. IP 42 BOPD, 27°, Arbuckle 3,755-61 ft. TD 3,761 ft. Opens West Lynd pool.

Saline County:

Kreb & Reese 1 Lundquist, NE NW NW 27-16s-3w. IP 25 BOPD, 37°, Maquoketa, 3,321-31 ft. TD 3,331 ft.

Seward County:

Anadarko Production Co. 1 Davies, 36-33s-32w. IP 3,500 M.c.f.d., Morrow 5,762-69 ft. TD 6,351 ft. Opens Arkalon field.

Stafford County:

Dunne & Gardner 1 Brown, SE NE NE 21-24s-13w. IP 104 BOPD, 37.5°, Arbuckle 4,075-77 ft. TD 4,077 ft. Opens East Van Lieu pool.

Tomlinson-Kathol 1 Smith, SE SE NW 23-25s-15w. IP 87 BOPD, 38°, Miss. 4,263-79 ft. TD 4,409 ft. East Haynes pool.

NORTH LOUISIANA

Bienville Parish:

The California Co. 1 Robert L. Colvin et al., 13-17n-7w, 2½ miles northwest of Bryceland. IP 1,200 M.c.f.d. and 2 BCPD, ½-in., 52.9°, TP 450 psi., perf. 8,689-8,704 ft., Hosston. TD 11,303 ft. Extends Bryceland field 1⅞ mile west.

SOUTH LOUISIANA

Acadia Parish:

Charles B. Wrightsman 1 George Orillion, 3-11s-1e. IP 50 BOPD (net), 50% water, 8/64-in., 33°, GOR 8,100 cu. ft. per bbl., TP 2,050 psi., perf. 10,212-16 ft. TD 10,250 ft. Extends Perry Point field 1 mile southwest, and new pay.

Bureauregard Parish:

Jefferson Lake Sulphur Co. and J. M. Huber Corp. 1 Janet F. Lyles, 36-5s-9w, 1½ miles east of East Longville field. IP 20.75 BOPD, 1½-in. choke, 48°, 1½-in., TP 40 psi., GOR 614 cu. ft. per bbl., perf. 8,962-70 ft., TD 8,984 ft. New-field discovery.

H. L. Hunt 8 Lutcher-Moore, 33-5s-12w, 3½ miles southwest of Bivens field. IP 89 BOPD, 10/64-in., 54.7°, GLR 10,112 cu. ft. per bbl., TP 2,300 psi., perf. 7,548-51 ft. TD 8,500 ft. New-field discovery.

Calcasieu Parish:

Texas Gulf Producing Co. 1 Albert Derouen, 36-10s-6w, 1 mile east of East Bell City field. IP 97 BOPD (net), 22% b.s. and w., 10/64-in. 56.4°, GLR 12,684 cu. ft. per bbl., TP 2,950 psi., perf. 10,482-10,528 ft., and 48 BOPD (net), 40% b.s. and w., 10/64-in., 49.3°, 75 psi., GOR 4 M.c.f. per bbl., perf. 10,270-82 ft. TD 11,160 ft. New pay and northwest extension in North Hayes field.

Herbert L. Dillon, Jr., 1 W. Boudreaux, 5-10s-6w, 2½ miles north of South Bon Air field. IP 54 BOPD, 1,722 M.c.f.d., 10/64-in., 55.2°, TP 3,350 psi., perf. 9,743-48 ft. TD 10,209 ft. New-field discovery—North Bon Air field.

Terrebonne Parish:

Superior Oil Co. 1 Robert C. Milling et al., 21-18s-17e, 3 miles south of Sunrise field. IP 31.32 BOPD (net), 19.4% b.s. and w., 5,704 M.c.f.d., 9/64-in., 39.2°, TP 12,200 psi., GLR 182,120 cu. ft. per bbl., perf. 16,684-94 ft. TD 17,090 ft. New-field discovery.

NEW MEXICO

Lea County:

Tennessee Gas Transmission Co. 1 G. E. Jordan-U.S.A., 12 miles southwest of

Malaga in 15-25s-32e. IPF 171 BOPD, 12/64-in. choke, 41° GOR 1,500:1, TP 100 psi., packer, Delaware sand 4,673-89 ft. TD 4,805 ft. PBTD 4,771 ft. New oil discovery.

McKinley County:

American Fiber Co. 1 State, C NE SE 16-19n-6w. IPP 65 BOPD, 41°, Gallup 2,938-3,008 ft. TD 3,400 ft. Gallup discovery, new field.

Roosevelt County:

Cosden Petroleum Corp. 1-C Federal, 4 miles southeast of Milnesand in 20-8s-36e. IPF 1,128 BOPD, 28/64-in. choke, 47°, GOR 1,650:1, TP 750 psi., packer, Bough C 9,653-62 ft. TD 9,900 ft. PBTD 9,858 ft. New oil discovery.

San Juan County:

El Paso Natural Gas Co. 1 Heaton, OWDD OTD 4,935 ft. IPF Dakota 4,214 M.c.f.d., ¾-in. choke, SITP 2,070 psi.; IPF Mesaverde 4,771 M.c.f.d., ¾-in. choke, SITP 908 psi., SICP 909 psi. Dakota 6,814-7,060 ft., Mesaverde 4,698-4,928 ft. TD 7,150 ft. Dakota discovery, new pool.

Redfern & Herd 1 Walker, SW NW 3-29n-12w. IPF 2,583 M.c.f.d., ¾-in. choke, SITP 1,973 psi., SICP 1,992 psi., Graneros-Dakota 6,384-6,556 ft. TD 6,620 ft. Graneros-Dakota discovery, new pool.

Delhi-Taylor Oil Corp. 1 Delhi-Mudge, NW NE 10-31n-11w. IPF 3,400 M.c.f.d., ¾-in. choke, SITP 2,220 psi., SICP 2,220 psi. Graneros-Dakota 7,078-7,355 ft. TD 7,580 ft. Dakota discovery, new pool.

1 Delhi-Stewart, NW SE NE 28-30n-10w. IPF 3,414 M.c.f.d., ¾-in. choke, SITP psi., SICP 2,037 ft. Graneros-Dakota discovery, new pool.

Century Drilling Co. 1-13 Royal-Federal, SW SW 3-24n-8w. IPP 141 BOPD, 40°, Gallup 5,590-5,818 ft. TD 6,825 ft. Gallup discovery, new pool.

NORTH DAKOTA

Billings County:

Hunt Oil Co. 1 N. Haag, C NE NE 21-144n-99w. IPP 70 BOPD, 207 BWPD, 40.4°, GOR 1,203:1 Fryburg 9,915-25 ft. TD 10,259 ft. Fryburg discovery, new field.

OKLAHOMA

Beckham County:

Cecil Simms 1 Russell, SW NE SE 9-8n-22w. IP 200 M.c.f.d., Granite Wash 1,800-90 ft. TD 1,909 ft. Shut in gas discovery.

Bryan County:

Sinclair Oil & Gas Co. 1 Anderson-Mayhue, NW NW SE SE 34-6s-9e. IPF 6,200 M.c.f.d., Bromide 7,072-7,110 ft., McLish 7,735-92 ft. TD 7,865 ft.

Comanche County:

Woods Petroleum Corp. 1 Wilson, C NE NE 20-3n-9w. IPF 8,500 M.c.f.d., Briscoe 7,039-54 ft., Yule-Funk 7,152-66 ft., Wade 7,300-32 ft. TD 8,775 ft.

Ellis County:

Pan American Petroleum Corp. 1 State of Oklahoma Gas Unit "K," C NW SE 33-21n-24w. IPF 1,300 M.c.f.d., Morrow 9,640-44 ft. TD 10,280 ft. 1 Wilson unit, C NW SE 35-22n-26w. IP 1,750 M.c.f.d., Morrow 9,344-48 ft. TD 9,960 ft.

Texoma Producing Co. 1 McClung, C SW NE 17-24n-24w. IPF 1,920 M.c.f.d., Morrow 7,720-94 ft. TD 7,900 ft. Luther Hill extension.

Hughes County:

Tom Jack 1 McKinzie, SW SW NE 8-5n-9e. IP 12 BOPD, 33°, lower Booch 2,736-60 ft. TD 2,970 ft.

Monsanto Chemical Co. 1 Sanford, C NW NE 13-9n-11e. IP 125 BOPD, 26 BWPD, Cromwell 3,354-64 ft. TD 3,600 ft.

Major County:

Pan American 1 Reames Unit, NW SE 29-20n-11w. IPF 7,200 M.c.f.d., Chester 7,378-90 ft. TD 9,046 ft.

McClain County:

An-Son Petroleum Corp. 1 Mantooth, C NW NW 7-5n-3w. IP 73 BOPD, Hartshorne 8,732-44 ft. TD 10,080 ft. New pay in Northwest Payne field.

Woodward County:

Ashland Oil & Refining Co. 1 Ezell unit, NW SW 35-21n-17w. IPF 15 M.M.c.f.d., Chester 7,922-37 ft. TD 8,125 ft.

NORTH TEXAS

Montague County:

McCommons Oil Co. 1 Donald, 1 mile east of Aries field in Robert Criedbring Sur. A-1076. IPF 216 BOPD, ¼-in. choke, 6,219-24 ft. 42°, packer, GOR 530:1. TD 6,291 ft. New oil pool.

Young County:

Sugg: Padgitt, West Mississippian field. Texaco Inc. 1 Oliver Abbott et al., 4 miles southwest of 4,972-ft. production, William Trundale Sur. A-275. IPF 660 BOPD, 10/64-in. 375 psi., tubing pressure. CP 500 psi., 42°, GOR 230:1. Miss. 4,722-56 ft. TD 4,785 ft. PBTD 4,783 ft. New oil discovery.

TEXAS GULF COAST

Bee County:

Robert L. Dirks et al. 2 Dirks-McKenzie. Jose Maria Uranga Grant, A-69, in Tuleta townsite. IP 17 BOPD, 37.3°, GOR 350 cu. ft. per bbl., perf. 3,116-40½ ft.; and AOF 2 M.M.c.f.d., dry gas, 1,029 psi., perf. 2,842-48 ft., Vicksburg. TD 4,018 ft. New-field discovery.

Carl Vickers, Inc., 2 Clay Murphy et al., Jose Maria Uranga Grant, A-68, 3 miles east of Tuleta. IP 32 BOPD, 13/64-in., 36.5°, TP 50 psi., perf. 3,492-96 ft., Hockley. TD 5,100 ft. New-field discovery.

Chambers County:

Estate of J. P. Petkas 1 Julia H. Casey Estate, James Grant Sur., A-102, 8½ miles southeast of Mount Belvieu. AOF 8 M.M.c.f.d., 11 BC per M.M.c.f., 49.2°, shut-in TP 2,235 psi., perf. 6,750-52 ft., Frio. TD 8,239 ft. Discovery well of Julia Casey field, ¾ mile northeast of Petkas field.

Jackson County:

Sun Oil Co. 257-3 Carancahua, Tract 257, Carancahua Bay. AOF 5,100 M.c.f.d., GLR 55,340 M.c.f. per bbl., 60.3°, shut-in TP 2,237 psi., perf. 7,657-63 ft., Frio. TD 8,207 ft. New pay in Appling field.

Texaco Inc., 5 J. F. Weed, John D. Newell Sur., A-61, 3 miles south of Francitas. IP 178 BOPD, 9/64-in., 36.6°, GOR 2,854 cu. ft. per bbl., TP 2,200 psi., perf. 8,720-32 ft., Frio. TD 9,100 ft. New pay in South Francitas field.

Jefferson County:

Meredith & Co. 1 Non Mills, J. C. Grant Sur., A-127, 4 miles northwest of Fannett. AOF 11 M.M.c.f.d., GLR 81.2 M.c.f. per bbl., 52°, shut-in TP 3,148 psi., perf. 9,134-44 ft., Nodosarida. TD 9,335 ft. New pay in Broussard field.

Kleberg County:

Humble Oil & Refining Co. 161 King Ranch Borregos, IP 185 BOPD, 3/16-in., 41.7°, GOR 5,189 cu. ft. per bbl., 2,680 psi., perf. 7,145-49 ft., Frio. TD 7,300 ft. New pay in Borregos field.

Lavaca County:

Shell Oil Co. 2 William Borchers, James Chester Sur., A-113, 6 miles northwest of Morales. AOF 8,800 M.c.f.d., dry gas, shut-in TP 994 psi., perf. 2,320-33 ft., Miocene. TD 10,654 ft. New pay in North Borchers field.

Live Oak County:

McGarr & Trusler et al. 1-B Maggie McNeill, Section 27, BS&F Sur., A-98, 8 miles south of Mikeska. AOF 5,100 M.c.f.d., GLR 200 M.c.f. per bbl., 60°, 1,794 psi., perf. 4,961-66 ft., upper Pettus. TD 5,905 ft. New-field discovery (East C. A. Winn).

Matagorda County:

Superior Oil Co. 1 E. V. Fant, Mrs. C. P. Fant Sur., 1 mile southeast of Blessing. IP 620 M.c.f.d., 72.9 BCPD, 12/64-in., 44.5°, TP 1,110 psi., perf. 8,713-19 ft., Frio; and 1,963 M.c.f.d., 64.4° BCPD, 12/64-in., 54.4°, 2,860 psi., perf. 8,555-59 ft. and 8,566-72 ft., Frio. TD 10,001 ft. New pay in Blessing field—extends production 1 mile southeast.

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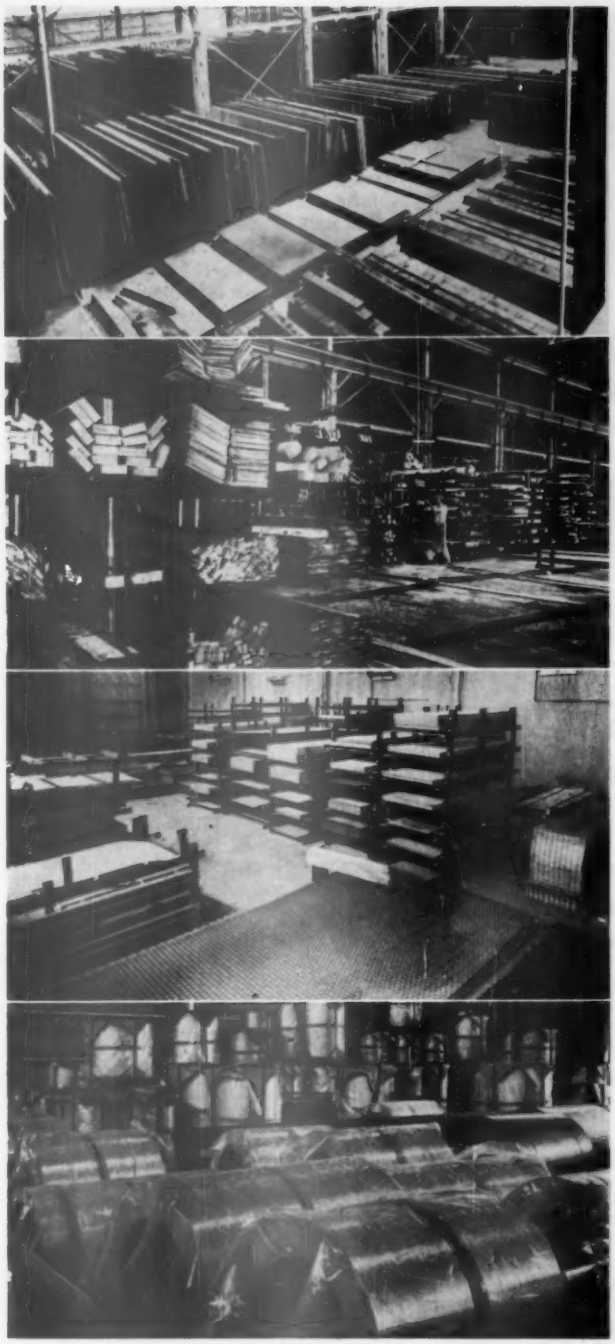

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Paul A. Tanner . . . he calls Skelly sales signals.

Tanner Pushes Skelly Sales

• The newest vice president of Skelly Oil believes the main ingredient in a top sales program is effort.

PAUL A. Tanner was 30 years old when he took a job as an office boy with Skelly Oil Co. in Omaha.

Now, 16 years later, he is a vice president of the company and general manager of marketing.

The office boy who moved fast is still pushing. Last year Skelly's gasoline sales reached an all-time high. But Tanner isn't satisfied.

"We're shooting for the strongest, best informed sales force ever," he says. "The individual is the secret of good selling. The man who keeps alert to customer needs, and uses all the sound techniques with which he's supplied is bound to get the job done."

Tanner does his part to keep his sales force supplied. He is a constant reader and tireless planner. He keeps a flow of informative, stimulating material moving to Skelly's field force. And he oversees a sharp and compact training program.

To the effervescent Tanner there is no mysterious formula which makes a master salesman. It's chiefly a matter of effort, effort, and more effort.

In the last 12 months, he has swung around the 18-state Skelly marketing territory frequently to visit and counsel the more than 1,600 dealers, salesmen and bulk deliverymen. He talks up the whole sales package—TBA, oils, LPG and home heating, gasolines and industrial fuels.

Background . . . Tanner was born on a farm near Memphis, Neb. Through grade and high school years farm chores were a part of his daily routine.

In the Ashland, Neb., high school he was a three-sport athlete. Tanner who is 6 ft., 5 in. tall, was end on the football team, played center in basketball, and was an every-game pitcher for the baseball team.

After his graduation from high school, Tanner took a job in Omaha as a laborer in the lamb department of the Armour packing plant. In 4 years he worked up to a spot called "industrial engineer."

His first sales job was gained when he answered a want ad for a salesman. He did house to house selling of LPG appliances, including stoves, refrigerators and assorted kitchen aids, for a Skelgas dealer.

For 2 years Tanner worked at this job on a straight commission basis. Then he became sales supervisor for a store with five employes under him. It was in 1944 that he went to work for Skelly as an office boy.

Only 2 years later he was assigned to Cedar Rapids, Iowa, as a district salesman. He moved back to Omaha in 1948 as assistant division manager and in 1953 went to Kansas City as division manager.

In November of last year Tanner was made general manager of marketing and last July he was elected vice president.

Tanner keeps his big frame moving in industry and civic affairs, too. He's on the jobbers advisory council and the general marketing committee of the American Petroleum Institute. He is a Rotarian and a member of the Kansas City Oilmen's Club.

▶▶▶ Personals

D. A. Hayse-Gregson has been transferred to Calgary as general superintendent of drilling and production for Texaco Exploration Co. He has been superintendent of field operations for Texaco Trinidad, Inc., where he has been stationed 14 years.

Richard L. Darrow, formerly organization analyst with Standard Oil Co. of California at San Francisco, has been transferred to Woodland, Calif., as crew geophysicist with Standard's Western Operations, Inc.

Dr. Joseph S. Levine, formerly senior chemist with Shell Development Co. at Houston, has been promoted to production laboratory supervisor with Shell in Denver.

Neal R. Montgomery has moved to Midwest, Wyo., as area engineer with Pan American Petroleum Corp. He formerly was petroleum engineer with Pan American at Casper.

Kenneth J. Hartwein has been transferred to Ventura, Calif., as production engineer with Shell Oil Co. He formerly was Shell's production engineer at Long Beach. **J. N. Rafidi,** Shell geologist at Donaldsonville, La., has been transferred to New Orleans as geologist there.

H. A. Rainbird, formerly with Arabian American Oil Co. in New York, has moved to Ras Tanura, Saudi Arabia, as production engineer.

Charles J. Reller, treasurer of Atlantic Refining Co., has been elected to the additional post of secretary, effective October 28. He succeeds **Richard Rollins,** retired. Reller joined Atlantic in 1926, and was elected treasurer in 1955.

Robert S. MacIntire has been named assistant controller and assistant treasurer of Shell Chemical Co., succeeding **Henry W. Egliht,** retiring after 36 years of service. MacIntire previously had been chief accountant at Houston and treasury manager of Shell's Sewaren, N. J., plant.

Ohio Fuel Gas Co., Columbus, has announced three personnel changes. **Roe E. Young** has been promoted to superintendent of stock control, succeeding **Emil J. Tresemer,** retired. **Dan J. Robinette** has been named superintendent of stores, succeeding Young.

Alexander B. Clarke, manager of the manufacturing department of Standard Oil Co. (Ohio) has been elected manufacturing vice president. A veteran of 19 years with Ohio, he will continue as manufacturing department manager.

William J. Schmidt, assistant vice president of sales for Long Island Lighting Co., has retired after more than 28 years of service. He had served as sectional vice president of the American Gas Association.

Camdrill International, Inc., has announced the following personnel changes: **Frederick Patterson,** formerly Socony Mobil comptroller in Egypt, has been named comptroller at Tripoli, Libya; **G. Ed Porter,** has been made manager at Las Palmas, Gran Canarias, Spain; **William A. Lyons** has been assigned as district manager at Benghazi, replacing Porter, and **Preston Dillon** has been made assistant superintendent of Camdrill International operations in Libya.

M. C. Hoffman, Chicago, has been elected president and a director of Alco Oil & Gas Corp. of Denver. Hoffman retired October 15 as vice president of Continental Illinois National Bank & Trust Co., Chicago. Previously, he had served in engineering and executive capacities with Pan American Petroleum Corp.

Wallace G. (Wally) Thomson, Denver, has been named vice president of government services for Century Geophysical Corp. of Tulsa. He will coordinate work between various government purchasing agencies and Century Electronics & Instruments, Inc., and Century Geophysical. He formerly was sales manager for Hathaway Instruments, Inc., Denver.

API Honors Holman for Oil Leadership

EUGENE HOLMAN, whose oil career spanned 43 years, will receive the American Petroleum Institute's "Gold Medal For Distinguished Achievement" at the API Chicago convention November 16.

Holman, a Texan who retired as board chairman of Standard Oil Co. (N. J.) last May after 41 years with Jersey and affiliates, was graduated in 1917 from Hardin Simmons University with a geological degree.

He worked in Cuba with an exploration party that year, served in World War I as an aerial photographer, went with the U. S. Geological Service after discharge, and in 1919 began service with Humble Oil & Refining Co. as geologist in North-Central Texas fields.

In 1929, Holman went to New York as assistant to Jersey's vice president in charge of production, was named Jersey president in 1944, and board chairman in 1954. He was chairman until his retirement this year.

He served on the API executive committee and is a director of the Chase National Bank, the Metropolitan Life Insurance Co., and The Borden Co. In announcing the citation, the API said Holman had "constantly campaigned for a minimum of government control of private industry." M. J. Rathbone, Jersey Standard president, will preside at the award ceremony.

Eugene Holman

Paul D. Harthorn, formerly senior refinery planning engineer with Creole Petroleum Corp., in Caracas, has joined Barrington International, Inc., management consulting firm, of New York. Harthorn now is stationed in Buenos Aires, Argentina.

Kelley E. Lawrence has been appointed petrochemical sales representative for Tennessee Oil Refining Co., a division of Tennessee Gas Transmission Co. He formerly was petrochemical salesman for Cosden Petroleum Corp.

James W. Young, manager of Imperial Oil Ltd.'s research and technical service department, will receive an honorary Doctor of Laws degree from the University of Alberta at a convocation in Calgary October 29. The university announced the degree in recognition of Young's "contributions to science and education in western Canada for almost 40 years." A dinner honoring Young will be held October 28 in Calgary, sponsored by the Chemical Institute of Canada.

H. E. Hughes has been appointed manager of Shell Chemical Co.'s isoprene rubber plant, to be constructed 15 miles west of Marietta, Ohio, on the north bank of the Ohio River. When completed late in 1961, the plant will have a capacity of 80 million pounds of isoprene rubber a year. Hughes joined Shell Oil Co. in 1934 and moved to Shell Chemical in 1939.

Sam Ray, Jackson, has been made Mississippi division manager for Hycatector Well Logging Service, Inc., of Thibodaux, La. He is a graduate of the University of Houston and formerly was with Larco Drilling Co.

John F. Eppler has been made technical computing supervisor at the Whiting research laboratories of Standard Oil Co. (Ind.). He will direct studies in use of electronic computers in designing refining equipment.

Jesse Sulter, Pierre, has been elected president of the South Dakota Independent Oil Men's Association. Other officers are **Howard Falen,** Sioux Falls, vice president; and **E. Klein Graff,** Sioux Falls, executive secretary. New directors are **L. L. Buehnen,** Mitchell, retiring president, named director at large; **Kenneth King,** Aberdeen, fourth district; **Walter Fisher,** Long Range, fifth district; **Peter Movotny,** Lake Andes, eighth district; and **Jake Hoff,** Murdo, tenth district. The 1961 convention will be held in Yankton.

PERRYMAN

BARNES

CONNALLY

O'NEILL

General American Names New Officers

W. LEWIS PERRYMAN, JR., executive vice president and general counsel, has been elected president of General American Oil Co. of Texas. He succeeds President Gordon Simpson, retired.

W. P. Barnes of General American's land department was named ex-executive vice president and general counsel. Promoted to senior vice presidents were L. P. O'Neill, vice president of production and engineering, and F. H. Connally, vice president and treasurer. Connally will continue as treasurer.

Re-elected board chairman was A. H. Meadows. He also was named chairman of the executive committee, succeeding D. V. Loflin, retired.

Three new directors were elected, increasing General American's board to 20. New directors are Barnes, O'Neill and Paul A. Conley, New York, with the investment firm of Blyth & Co., Inc.

N. W. Krouskop was made vice president of production; J. M. Haas was named vice president of engineering; George Rhodus was made administrative vice president; J. W. Goss was named vice president of land operations, and C. R. Lammers was appointed assistant secretary.

R. M. Swesnik, vice president of foreign operations, was made president of two wholly-owned subsidiaries, General American Oils Ltd., operating in Canada, and GAO of Spain, Inc., operating in Spain and the Spanish Sahara.

I. S. Larkin, formerly a senior engineer in New York for Shell Oil Co., has been named assistant manager, engineering office, at Shell's Martinez, Calif., refinery.

Bert W. David, geologist with Welsh Oil & Gas, Houston, has opened offices as consulting geologist in Houston.

Roger M. Matson, Denver, has been named chief geologist, and **Owen Bennett,** Oklahoma City, has been appointed staff geologist, for King-Stevenson Oil Co., Inc., of Denver. Matson, a University of Washington

BENNETT

MATSON

graduate, formerly was chief geologist for Vickers Petroleum Co., and Bennett, a University of Oklahoma graduate, served as district geologist for Signal Oil & Gas Co., Tulsa.

Charles W. Sternberg, geologist with Amurex Oil Co. of Calgary, has been transferred to El Dorado, Ark., as geologist with the Murphy Corp.

William N. Pritchett, Oklahoma City, has been named manager of the Southern Sales Region for Kerr-McGee Oil Industries, Inc., covering the Oklahoma City and Memphis sales districts. Pritchett, a 1948 graduate of Ohio University, has spent 12 years in oil marketing work in the Midwest.

John D. Bartlett has transferred to Denver as staff geologist with Texaco Inc. He formerly was staff geologist with Texaco at Houston.

Jack L. Thompson, assistant foreman for Sohio Petroleum Co., has been transferred to Lake Charles, La., from Houston.

John Barnard, Jr., Boston, attorney and partner in the law firm of Gaston, Snow, Motley & Holt, has been elected a director of Skelly Oil Co. Barnard also is trustee of Consolidated Investment Trust and a director of Digital Equipment Corp., Maynard, Mass. Barnard's election increases the Skelly board to 10 members.

▶▶▶ Personals

L. T. Braun has been named chief geologist of Geophoto Services, Ltd., of Calgary. He joined Geophoto in Denver in 1951 and has been in Calgary since February 1959. A graduate of the University of California, he previously was with Atlantic Refining Co. and the California State Division of Mines.

Fraizer M. Stewart, petroleum engineer in the oil and public utilities division of Continental Illinois National Bank & Trust Co., Chicago, has been elected second vice president in the Continental's commercial banking department. He formerly was chief engineer for Alex W. McCoy Associates, Tulsa, and with Pan American Petroleum Corp.

E. Leslie Trice, Jr., formerly Mobil Oil Co. geologist at Roswell, N. M., has moved to Wichita Falls, Tex., as geologist in the Mobil office there.

C. K. Smith, production superintendent with Kirby Petroleum Co. at Tulsa, has transferred to Houston to be Kirby's manager of production.

W. O. Ham, Jr., Houston, and **H. F. Nabors,** New York, have been elected vice presidents of Continental Oil Co. Ham is general manager of domestic exploration. He began his Continental service in 1943 and was made regional geologist in 1952 at Fort Worth. He moved to Houston

HAM

NABORS

in 1956 as director of organization and planning, and became coordinator of reserves purchases in 1958. He will continue to make headquarters in Houston. Nabors joined Continental in 1935 in New Mexico and served in production capacities in New Mexico, Wyoming, Colorado, and Texas. From 1949 to 1955, he was in Houston as southern region production manager, spent 4 years in Oklahoma City in the central region office, and early this year transferred to New York as production manager for foreign exploration and production. He will remain in the New York office.

Dr. Frederico G. Baptista, a native of Venezuela and assistant production manager for Creole Petroleum Corp., has been elected to the Creole board. He was born at Coro, Venezuela, in 1914, and began his career with Creole in 1936 as an engineer at Caripito. After holding several production posts, he was appointed chief oil engineer at Caracas in 1948. After serving in the production coordination department of Creole's parent company in New York, Standard Oil Co. (N. J.), Baptista returned to Venezuela as assistant manager of production. He did postgraduate work at Texas A & M College and at the Massachusetts Institute of Technology.

Dr. Ward S. Motte has begun duties as ground-water geologist for the Oklahoma Geological Survey, Norman. A graduate of Columbia University in 1949, he obtained his master's degree at the University of Minnesota and his doctorate at the University of Illinois. He worked as a mining geologist in Mexico and since 1953, has been ground-water geologist for the U. S. Geological Survey in New Mexico.

H. J. Fitzgeorge, Midland, has been appointed exploration adviser for Mobil Oil Co. in New York, effective November 1. He now is exploration superintendent in the Midland district. He previously served as district geologist at Mount Vernon, Ill., and Wichita Falls. **Henry K. Holland, Jr.,** operating superintendent for Mobil's Denver division, has been named producing adviser for Mobil in New York.

John F. Keith, Jr., has transferred from geologist with Arkansas Fuel Oil Corp. at Jackson, Miss., to New York City as staff geologist with Cities Service Petroleum, Inc.'s foreign department.

Four marketing executives of Gulf Oil Corp. will be transferred from Houston and New Orleans to the newly-created Tulsa marketing division, under **M. C. Enright,** manager. **W. R. Phillips,** head of TBA sales at Houston, will become sales coordinator. **W. G. Crouch,** superintendent of supply and distribution at New Orleans, will be in charge of supply and field services. **J. W. Williams,** assistant district manager for Gulf at Houston, will be supervisor of dealer and sales training. **G. L. de Verges,** manager of employe and dealer relations at New Orleans, will be supervisor of office services in Tulsa. The Tulsa division handles operations in Arkansas, Oklahoma, the Texas Panhandle, and fringe areas of bordering states.

James Eplin, Grayville, Ill., is new production superintendent for Cobra Oil & Gas Co., Inc., Evansville, Ind.

New Orleans Geologists Name Officers

NEWLY ELECTED officers of the New Orleans Geological Society took office at the October meeting. They will serve through September, 1961. The new officers are, front row, left to right, Leonard L. Limes, Kerr-McGee Oil Ind., Inc., vice president; Jules Braunstein, Shell Oil Co., president; and L. W. Funkhouser, The California Co., director. Second row, Jack D. Cox, left, of John W. Mecom, treasurer; and David N. Schell, right, Superior Oil Co., secretary. Limes served the last year as secretary.

James E. Hara, who joined Skelly Oil Co. in 1948, has been elected a vice president, and named assistant to the president. A law graduate from the University of Texas, Hara did trial work for Skelly in Texas and Louisiana and 3 years ago was made an executive assistant in headquarters offices, Tulsa.

▶▶▶ Deaths

William Bailey Chamberlain, 90, known as the first man to drill for oil in the Edmonton, Alberta, area, died October 13 at Edmonton. He built a wooden derrick on his farm, east of Edmonton, in 1912. It was 40 years later before oil was discovered and two more wells drilled. The derrick stook as a landmark for 35 years.

Edmond-Marc Isaac, 67, died October 3 at his home in Woluwe-Saint-Pierre, France. A civil engineer, he had been director general of S.A. Petrochim.

Homer W. Forschner, 54, general sales manager of Electric Machinery Manufacturing Co. of Minneapolis, died October 8 at his summer home on Lake Minnetonka. He had been with Electric Machinery 32 years.

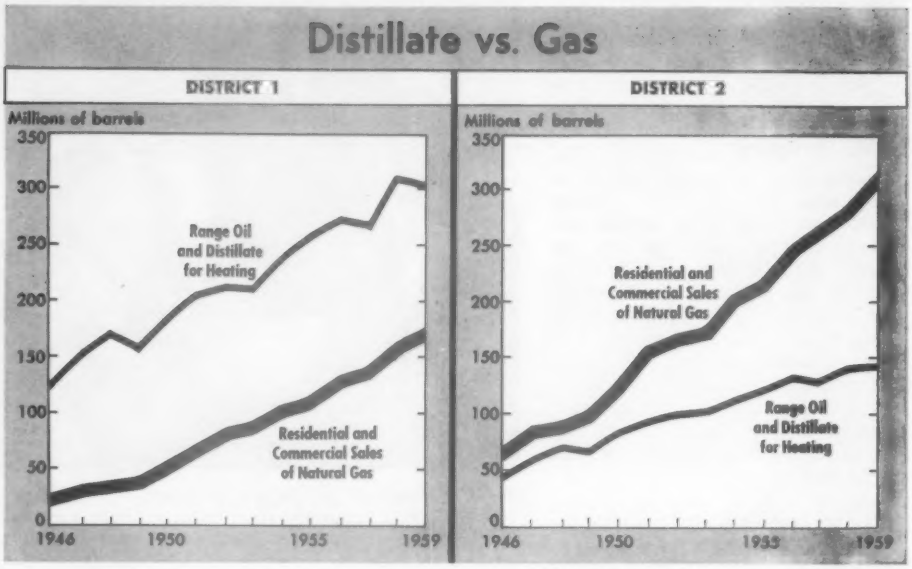
Gilbert Nesheim, 72, former president of the Allied Oilwell Supply Co. of Los Angeles, died October 9.

William F. Lyte, 59, vice president of Douglas Oil Co. of California, and general manager of United Asphalt Co., died October 9 while traveling in Europe. He was a director of the Asphalt Institute, Associated General Contractors of Los Angeles, and Fortifiber Paper Co.

Albert Edmund Kirkland, 73, who with his father, John L. Kirkland, founded the Kirkland Oil Co., died October 8 in a Tulsa hospital. He retired 25 years ago.

Gilbert D. Moyle, 62, Salt Lake City, died October 13 at the home of a daughter in Ogden. He was active in Utah oil operations from 1924 until he retired in 1950.

Omer P. Rennels, 65, formerly with Standard Oil Co. of California, died October 4 at his home in Taft, Calif. He retired from California Standard in June 1957.



RESIDENTIAL and commercial sales of natural gas account for only about 32% of marketed production, but this is an important part. The average residential customer paid $1.01 per M.c.f. for his gas last year. Commercial customers paid $0.72. The average value for all gas at point of consumption was $0.477.

Gas is distillate's big competitor

BY JOHN C. CASPER

GAS AND DISTILLATE fuels have played near-opposite rolls in Districts 1 and 2 since the end of the war.

In District 1 sales of distillate fuel and range oil for heating have been well ahead of residential and commercial sales of natural gas every year. In fact, the 13-year gain by distillate has been larger than the increases reported for gas. Note on the chart that the oil line is above the line representing gas. Also, the lines are a little farther apart at the end of the period than at the start.

Now take a look at the chart for District 2. Gas sales were a little ahead of oil sales at the end of the war and have stretched that lead in the postwar period.

For the country as a whole, the trend takes on some of the characteristics of both districts. Distillate was ahead of gas at the start of the period. But gas increased at a faster rate and was well in the lead at the end of 1959.

First, here is the picture of oil-gas competition for the country as a whole. (All comparisons will be between sales of distillate plus range oil for heating, and residential plus commercial sales of natural gas. Gas figures are expressed as the energy equivalent of distillate in barrels.)

For the year 1946, residential and commercial sales of natural gas amounted to 160,396,000 bbl. Oil men sold 192,742,000 bbl. of distillate and range oil for heating. Thus, gas sales were 16.8% under distillate sales. Gas sales forged ahead of distillate in 1951 and continued to gain. Last year, gas was ahead by 41%.

District 2 is the big market area for residential and commercial gas. This district which includes the Mid-Continent and North Central States accounted for 46% of gas sales last year compared with 42% just after the end of the war. Within the district, gas was leading distillate by 21,000,000 bbl. at the end of World War II and had climbed to a lead of 170,000,000 bbl. last year.

Rapid gains by natural gas have had a depressing influence on sales of distillate fuels. For the 1946-59 period, gas sales gained 369%. Distillate gained only 219%.

On the East Coast, natural-gas sales have shown good percentage gains, but these relative gains have been due more to low sales in the early postwar years than to big numerical increases.

Note that oil sales in District 1 last year were almost twice the volume of gas sales. Just the opposite was true for District 2 where gas sales were a little more than double distillate sales.

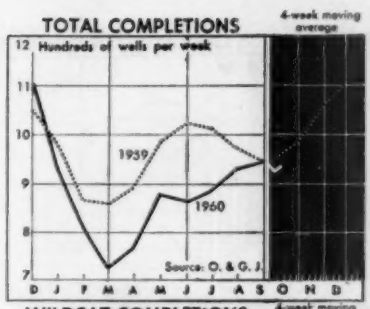
A quick look at the highlights . . .

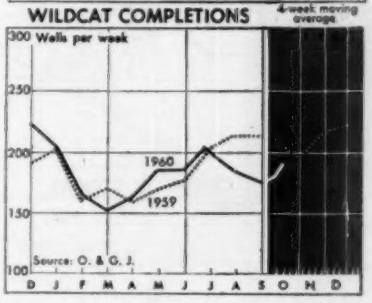
	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,835,875	UP	21,765	DOWN	71,571
Crude stocks	299,988,000	DOWN	1,885,000	DOWN	20,935,000
Completions	968	UP	97	UP	50
Refinery runs	7,898,000	UP	18,000	UP	139,000
Gasoline stocks	188,159,000	DOWN	483,000	UP	9,427,000
Kerosine stocks	35,987,000	UP	866,000	UP	2,547,000
Distillate stocks	175,066,000	UP	3,629,000	DOWN	4,924,000
Residual stocks	51,427,000	UP	661,000	DOWN	8,318,000
Four-product stocks	450,639,000	UP	4,673,000	DOWN	1,268,000
Total imports	1,608,600	DOWN	37,600	UP	158,200

Active Rotary Rigs

	10-17-60	10-10-60	10-19-59
Alabama	2	2	5
Alaska	7	7	(†)
Arkansas	13	12	14
Arizona	2	2	1
California	71	69	101
Land	68	67	96
Offshore	3	2	5
Colorado	58	59	54
Florida	3	3	3
Land	2	2	2
Offshore	1	1	1
Georgia	1	1	0
Illinois	52	48	35
Indiana	8	10	8
Iowa	1	1	0
Kansas	113	110	134
Kentucky	5	6	11
Louisiana	262	288	328
North	26	28	43
S. Inland waters	98	120	104
S. Land	81	84	123
Offshore	57	56	58
Maryland	0	0	0
Michigan	31	35	37
Mississippi	60	62	74
Missouri	1	1	0
Montana	19	24	21
Nebraska	25	28	22
Nevada	0	0	1
New Mexico	105	106	108
New York	2	2	0
North Dakota	17	15	15
Ohio	4	5	6
Oklahoma	170	179	210
Oregon	1	1	0
Pennsylvania	8	9	12
South Dakota	0	1	8
Texas	594	597	693
S. Inland waters	5	8	1
S. Land	163	154	184
Offshore	1	1	2
North	42	47	174
Panhandle	44	45	(*)
East	59	55	(*)
West Central	168	169	189
West	112	118	143
Utah	27	25	29
Washington	1	1	2
West Virginia	6	6	7
Wyoming	68	74	89
Total U. S.	1,737	1,789	2,028
Western Canada	157	159	181
Eastern Canada	1	0	1
Grand total	1,895	1,948	2,210

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.



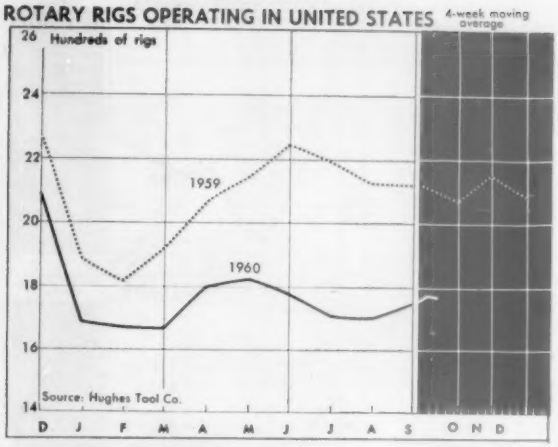


WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 15, 1960

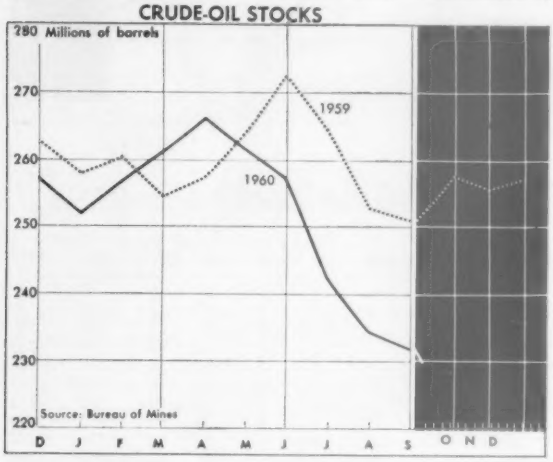
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	36	78	0	0	0	0	0	2	20
Arizona	0	0	0	0	0	0	0	28	23	0	0	0	0	0	18	21
Arkansas	10	2	0	0	8	0	39,566	471	669	2	0	0	0	2	126	118
California	31	22	0	1	8	0	136,842	1,295	1,206	3	0	0	0	3	244	317
Colorado	11	1	0	2	8	0	55,749	499	612	6	0	0	0	6	255	358
Illinois	51	19	0	0	22	10	113,176	1,795	1,796	14	1	0	0	13	380	295
Indiana	24	3	0	0	20	1	39,453	833	647	6	0	0	0	6	304	222
Kansas	116	63	0	8	37	8	287,181	3,111	3,171	26	7	0	1	18	835	819
Kentucky	95	45	0	13	37	0	126,815	1,656	1,926	18	4	0	3	11	156	232
Louisiana	74	29	10	3	32	0	578,682	2,810	2,978	16	2	1	0	13	432	404
North	28	11	0	3	14	0	113,002	1,064	1,155	7	2	0	0	5	210	178
South	39	15	8	0	16	0	400,827	1,357	1,500	8	0	1	0	7	196	211
Offshore	7	3	2	0	2	0	64,853	389	323	1	0	0	0	1	26	15
Michigan	24	9	0	1	14	0	83,046	740	498	10	0	0	0	10	197	129
Mississippi	9	3	1	0	5	0	98,661	537	500	5	0	0	0	5	207	223
Montana	9	1	0	0	8	0	44,893	258	248	5	0	0	0	5	122	82
Nebraska	22	6	0	0	16	0	116,418	692	717	11	0	0	0	11	290	307
New Mexico	50	23	0	20	3	4	259,090	1,490	1,650	0	0	0	0	0	212	193
West	29	5	0	19	1	4	161,399	533	738	0	0	0	0	0	59	51
East	21	18	0	1	2	0	97,691	957	912	0	0	0	0	0	153	142
New York	0	0	0	0	0	0	0	258	217	0	0	0	0	0	38	19
North Dakota	11	5	0	0	6	0	64,919	237	361	4	0	0	0	4	64	67
Ohio	19	10	0	1	6	2	50,049	840	802	1	0	0	0	1	40	23
Oklahoma	59	27	1	7	21	3	240,440	3,572	4,473	8	1	1	0	6	573	689
Pennsylvania	0	0	0	0	0	0	0	519	441	0	0	0	0	0	10	10
South Dakota	0	0	0	0	0	0	0	19	14	0	0	0	0	0	8	6
Texas	310	141	19	8	127	15	1,272,526	12,392	14,998	76	5	0	0	71	2,551	2,827
Dist. 1	19	11	0	0	8	0	48,339	871	865	5	0	0	0	5	324	259
Dist. 2	15	5	4	3	3	0	105,851	603	627	1	1	0	0	0	150	180
Dist. 3	27	10	4	0	13	0	168,449	941	960	7	0	0	0	7	177	193
Dist. 4	21	6	2	1	11	1	116,282	855	1,069	5	0	0	0	5	238	263
East	22	11	2	0	9	0	116,327	1,008	1,012	6	0	0	0	6	207	194
Dist. 7-B	26	10	1	1	14	0	95,118	1,782	2,054	9	1	0	0	8	507	554
West	57	36	0	1	18	2	282,328	3,205	4,553	13	1	0	0	12	495	625
Dist. 9	87	36	1	0	45	5	181,876	2,306	2,815	27	2	0	0	25	406	471
Dist. 10	36	16	5	2	6	7	157,956	821	1,043	3	0	0	0	3	47	88
Utah	3	2	0	0	1	0	21,095	184	244	1	0	0	0	1	68	65
West Virginia	18	1	0	13	4	0	46,435	652	623	1	0	0	1	0	7	26
Wyoming	21	11	0	1	9	0	110,129	815	765	8	0	0	0	8	329	267
Misc. (Iowa)	1	0	0	0	1	0	770	116	80	1	0	0	0	1	106	53
Total U. S.	968	423	31	78	393	43	3,785,935	35,855	39,737	222	20	2	5	195	7,574	7,792
Previous week	871	420	21	71	327	32	3,594,746	.....	.....	192	21	1	11	159	.....	.....
Cum. 1960	35,855	16,199	1,044	2,963	13,698	1,951	149,406,350	.....	.....	7,574	675	81	260	6,558	.....	.....
Cum. 1959	39,737	19,723	982	2,969	14,945	1,118	165,525,087	.....	.....	7,792	716	92	251	6,733	.....	.....
Western Canada	28	10	0	3	15	0	171,566	1,813	1,934	13	1	0	1	11	481	543

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	10-8-60	10-1-60	10-10-59
Pennsylvania	2,323	2,356	2,583
Other Appalachian	1,449	1,328	2,131
Illinois, Indiana, Michigan	8,972	8,756	9,551
Nebraska and North Dakota	2,825	2,710	3,060
Kansas	8,197	8,321	9,787
Oklahoma	14,926	15,116	14,323
Arkansas	1,790	1,819	2,082
Louisiana	18,209	18,424	17,989
North	2,967	2,981	3,272
South	15,242	15,443	14,717
Mississippi, Alabama, Florida	1,845	1,762	2,434
New Mexico	8,361	8,426	7,758
Texas	96,584	97,554	108,777
East Texas	7,691	7,434	8,098
West Texas	47,544	47,913	50,943
Texas Gulf	16,441	16,488	19,109
Other Texas	24,908	25,719	30,627
Wyoming	15,244	15,602	16,399
Other Rocky Mountain	9,656	8,942	9,511
California	26,159	26,630	28,885
Foreign	†13,448	14,127	15,653
Total	**229,988**	231,873	250,923

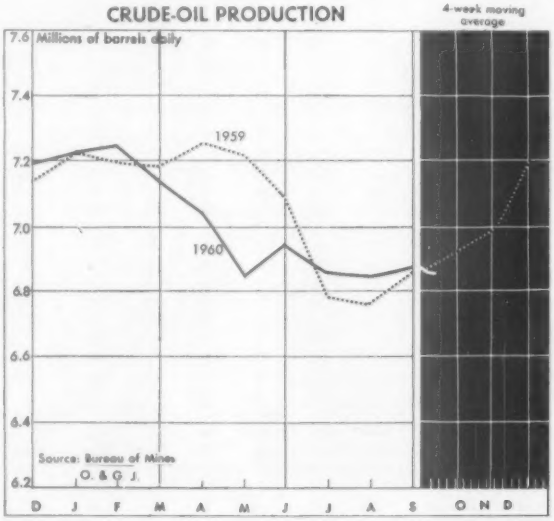
*Bureau of Mines. †Includes 4,703,000 bbl. in California.

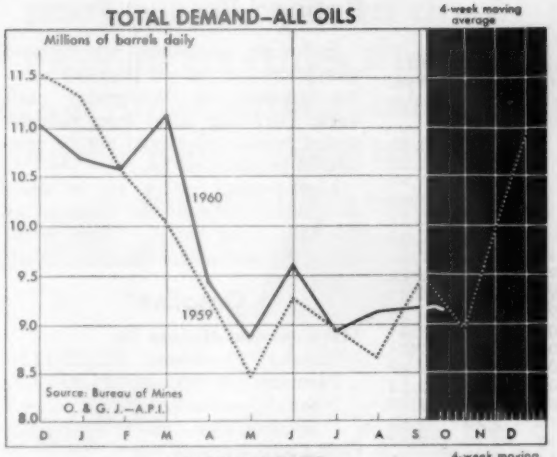
DAILY AVERAGE PRODUCTION FOR WEEK

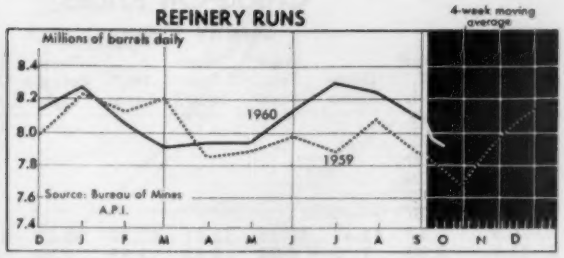
	October 15, 1960			Oct. 8
	Crude oil	Lease condensate	Total	total
Alabama	21,000	....	21,000	21,300
Arkansas	77,425	200	77,625	77,575
California	829,700	.....	829,700	829,300
Colorado	131,200	.....	131,200	131,400
Eastern	41,000	.....	41,000	41,200
Florida	1,000	.....	1,000	1,000
Illinois	217,900	.....	217,900	213,600
Indiana	31,400	.....	31,400	31,100
Kansas	†303,850	.....	†303,850	†301,635
Kentucky	56,900	.....	56,900	56,900
Louisiana	945,500	125,650	1,071,150	1,071,150
North	104,500	5,900	110,400	110,400
South	841,000	119,750	960,750	960,750
Michigan	41,900	.....	41,900	41,900
Mississippi	134,000	3,800	137,800	137,800
Montana	83,100	.....	83,100	82,500
Nebraska	68,400	.....	68,400	69,100
Nevada	50	.....	50	100
New Mexico	285,000	8,700	293,700	293,700
North Dakota	61,000	.....	61,000	60,700
Oklahoma	†502,300	.....	†502,300	†479,300
Texas	2,331,000	82,575	2,413,575	2,413,575
Dist. 1.	43,000	2,500	45,500	45,500
Dist. 2	97,000	8,100	105,100	105,100
Dist. 3	297,000	36,500	333,500	333,500
Dist. 4	169,000	11,900	180,900	180,900
Dist. 5	25,000	300	25,300	25,300
Dist. 6	101,000	10,000	111,000	111,000
East Texas field	121,000	.....	121,000	121,000
Dist. 7-B	121,000	150	121,150	121,150
Dist. 7-C	114,000	3,050	117,050	117,050
Dist. 8	948,000	7,500	955,500	955,500
Dist. 9	194,000	1,650	195,650	195,650
Dist. 10	101,000	925	101,925	101,925
Utah	90,000	.....	90,000	98,700
Wyoming	359,700	.....	359,700	358,900
Others	‡1,625	.....	‡1,625	‡1,675
Total U. S.	6,614,950	220,925	**6,835,875**	6,814,110
Change from prev. week, up			21,765	
Canada	†542,000	.....	†542,000	†472,000
Total U. S. prod.—Jan. 1-Oct. 15			2,020,464,500 bbl.	
Same period last year (crude plus cond.)			*2,031,265,400 bbl.	

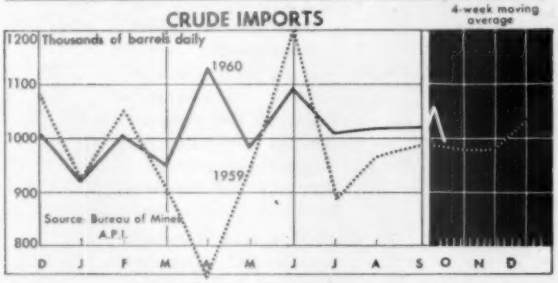
*Includes 53,872,000 bbl. condensate. †Week ended previous Monday. ‡Alaska, South Dakota, and Arizona.

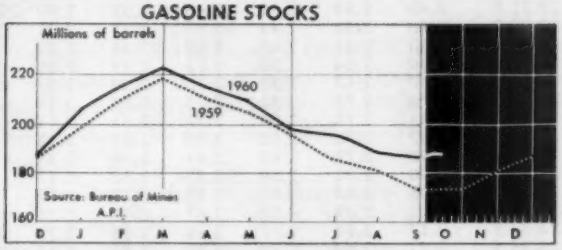
CRUDE-OIL PRODUCTION

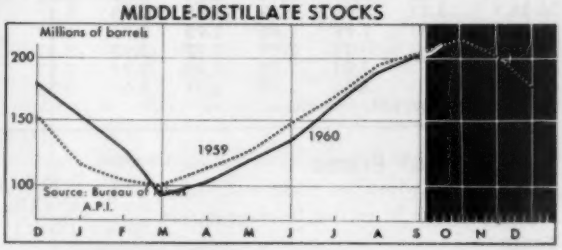


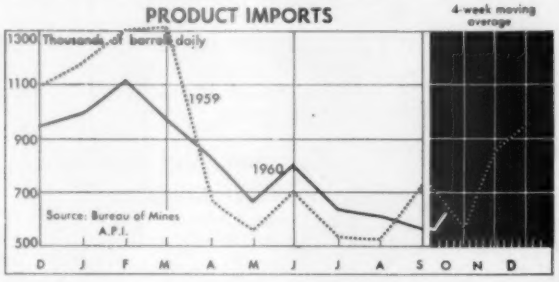

TOTAL DEMAND—ALL OILS
Millions of barrels daily
4-week moving average
1960
1959
Source: Bureau of Mines
O. & G. J.—A.P.I.
D J F M A M J J A S O N D

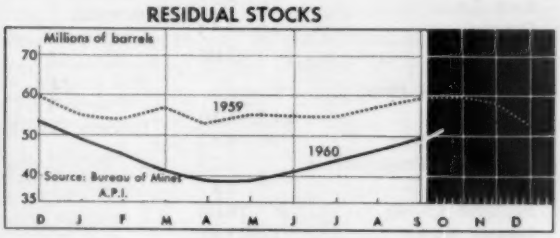












API REFINERY REPORT—OCTOBER 14, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, October 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,160	520.0	38.7	337.6	118.4	43,838	14,503	68,488	14,079	1,051	469.7	21.3	325.0	150.0
Appalachian:														
District 1	100	42.4	4.7	16.9	13.6	6,187	829	4,472	574	91	39.3	2.5	20.0	9.0
District 2	108	58.0	9.9	21.7	10.0	2,913	533	1,752	311	104	51.3	5.8	17.9	8.8
Ind., Ill., Ky.	1,452	738.2	82.7	289.0	158.6	32,755	7,467	30,750	6,592	1,421	739.2	64.0	311.8	134.5
Minn., Wis., Dak.	113	54.0	0.3	34.0	13.6	6,215	1,544	8,796	592	71	31.2	0.8	14.9	11.3
Okla., Kans., Mo.	661	376.1	7.6	160.4	20.1	16,616	1,723	14,902	1,020	688	385.6	16.2	170.2	24.1
Inland Texas	290	219.9	6.7	47.0	19.4	6,832	626	1,545	2,544	287	212.4	9.1	48.7	18.2
Texas Gulf Coast	1,816	967.5	131.4	427.9	113.0	25,288	3,829	17,108	5,947	1,718	910.3	102.5	412.0	143.6
La. Gulf Coast	684	359.7	73.8	102.0	44.0	10,326	2,016	7,267	1,505	693	378.5	55.3	150.1	54.6
N. La. and Ark.	109	65.7	7.7	20.1	4.9	5,235	1,078	2,553	115	67	25.8	2.2	17.9	5.3
Rocky Mtn.:														
New Mexico	13	8.1	0.6	2.4	1.6	605	44	159	30	27	14.7	0.5	5.3	2.8
Other	284	139.3	3.6	63.0	27.1	5,260	387	2,935	1,077	277	135.2	2.6	60.9	32.1
West Coast	1,108	525.1	40.4	172.7	275.4	26,089	1,408	14,339	17,041	1,152	507.1	3.8	181.3	275.0
Oct. 14, 1960	7,898	4,074.0	408.1	1,694.7	819.7	188,159	35,987	175,066	51,427	7,647	3,900.3	286.6	1,736.0	869.3
Oct. 7, 1960	7,880	3,961.9	324.0	1,694.0	847.1	188,642	35,121	171,437	50,766	.....	.....	.....	.....	.....
Oct. 16, 1959	7,759	4,015.9	308.1	1,685.1	857.0	178,732	33,440	179,990	59,745	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinisehd. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Jules-burg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.75-4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin 3.00-3.05

Foreign

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0°-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qata, 41.0°-41.9°, Umm Said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Smiley (Sask.) 2.18
- Pembina 2.38

Venezuela:
- Cumbarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton

(Latest reported spot fixtures)
- Carib.-NY, dirty (ATRS—50% $1.38
- ★ Carib.-Gothenburg, clean (Scale—35%) (22s. 9d.) .. 3.16
- ★ PG-UK, dirty (Scale—40%) (34s. 11d.) . 4.90
- PG-Japan, dirty (USMC—60%) 4.08

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) .. $12.25-12.50
- Premium (99 octane) . 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 11.00
- Regular (92 octane) .. 11.25
- Premium (98 octane) . 12.25

California (rack) Los Angeles:
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) . 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) . 10.125-10.25
- Premium (97 octane) 11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 .... 10.125-10.375
- Diesel oil (58 d.i. and above) 9.75-10.00
- Distillate No. 1 ..... 9.75-10.00
- Distillate No. 2 ..... 8.75- 9.00

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 9.00- 9.25
- Distillate No. 2 ..... 8.25

New York Harbor (barges):
- Kerosine 41-43 ..... 10.45
- Distillate No. 2 ..... 9.45
- Diesel fuel, 48-52 d.i. 9.65

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.90

Gulf Coast (cargoes):
- Bunker C fuel 2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C 2.10

California (rack):
- Bunker C fuel, Los Angeles 2.25

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Box M-136, The Oil and Gas Journal Tulsa, Oklahoma

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Department of the Interior Bureau of Indian Affairs Consolidated Ute Indian Agency Ignacio, Colorado

SEALED BIDS will be received until 2:00 P.M. Mountain Standard Time, November 15, 1960, and opened at that time in the Office of the Superintendent Consolidated Ute Indian Agency, Ignacio, Colorado, for the leasing of 17,423.98 acres of Tribal land and 1,518.63 acres of allotted Indian land, located in Township 33 N., Ranges 3 and 4W., N.M.P.M., Archuleta County, Colorado, Township 34N., Range 7W., N.M.P.M., La Plata County, Colorado, Township 32N., Ranges 15 and 16 W., N.M.P.M., Montezuma County, Colorado, Township 35 S., Ranges 20 and 21 E., S.L.M., San Juan County, Utah, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Consolidated Ute Indian Agency, at Ingacio, Colorado.

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Yugoslavian Lines

. . . moving crude and gas are placed in service.

A GROUP of small pipeline projects are making big changes in Yugoslavia's oil and gas industry.

One short, 11-mile system is now carrying crude from Struzec fields in Croatia to a refinery at Sisak. Line throughput will average about 6,000 bbl. daily this year, but design capacity is 20,000 bbl. daily.

Struzec is now the best oil area in Yugoslavia, with proven reserves estimated at 25 million tons, or about 180 million barrels. This production has helped raise the country's total present output to 19,500 bbl. daily.

A year-old, 80-mile gas line is moving about 1 million cubic feet daily from fields near the Sava River to Sisak. A smaller line is delivering gas 17 miles from Velika Greda and Vrsac fields to nearby industries.

A 60-mile gas line from Banat fields is being built to Pancevo, where a fertilizer plant is under construction. It will move more than 1 million cubic feet daily.

Bavarian Line Gets Bigger

A PROPOSED crude pipeline into Bavaria will open with an initial capacity of 80,000 to 100,000 bbl. daily with one pumping station.

Karlsruhe-Bayern Olleitung is now considering a 24-in. rather than a 22-in. diameter pipe for the 155-mile line which will run eastward into Bavaria from Karlsruhe. Governmental authorities have been asked to approve a route running north of Muhlacker, Ludwigsburg, Aalen-Wasseralfingen, and Nordlingen. Participating companies include British Petroleum, Esso, Deutsche Erdoel, Shell, Gelsenberg-Benzin, Mobil, Schloven-Chemie, and Wintershall.

Syrian Stepout Hits Good Pay

THE EIGHTH well at Karachuk field in northeast Syria tests 3,500 bbl. daily through a 2-in. choke under a pressure of 221 psi.

The stepout is the fifth well to be brought in as a producer, and is by far the best. Operations are being carried out by the UAR General Petroleum Authority, which took over after the UAR cancelled concessions covering 770,000 acres held by American interests.

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- **PVM for positive measurement of liquid from separator, treater or tank**
- **PVM for positive determination of well production for proration or commingling**
- **PVM and core barrel sampler for positive determination of B S & W content**

The PVM overcomes the difficulty in obtaining 100% repeatability inherent in other types of cyclic volume meters.

The PVM is fluid packed, sampled and then counted as the liquid is discharged. Its accuracy is indisputable as to volume of liquid measured at the pressure-temperature condition of operation.

The PVM may be calibrated for an exact volume with compensation made for a given composition, temperature and pressure.

The PVM is available with Core Barrel Sampler* which will complete the requirements for metering oil field liquids. The Sampler cuts a core vertically through the liquid and deposits same in a container. Thus an exact and representative core is taken from a fixed volume. The composite sample when analyzed will give the true percentage of oil, water and/or emulsion that has been metered.

NATIONAL'S PLUS VALUE — Engineers and field service crews available from over 50 service and warehouse stocking points to size, install and service National PVMs.

* Core Barrel Sampler is a trademark of National Tank Company

It's a National®

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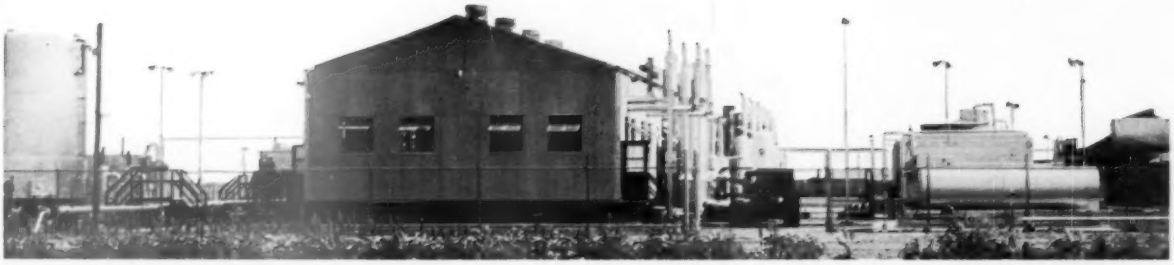
DRAWER 1710

TULSA, OKLAHOMA

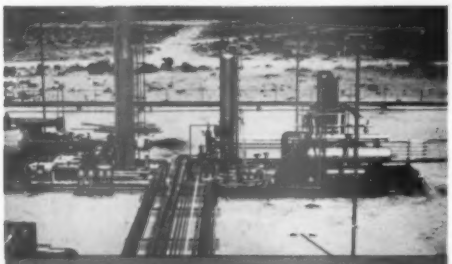
from drawing board to installation . . .

Southwest

specializes in TURNKEY operations



Southwest designed, engineered and installed this prefabricated water pumping station for a Pan American Petroleum Corporation unitized water-flooding operation in Southwest Texas.



This packaged, mechanical refrigeration type natural gas line plant was built by Southwest on a turnkey contract that included complete process, design, and installation engineering for a major oil company in West Texas.

This barge-mounted compressor station, including dehydration facilities and incorporating 1600 h.p. of compression in four units, is utilized in offshore gas boosting for transmission sales by the CATC Group at Grand Isle, La.

In main line boosting for a major gas transmission company along the Texas Gulf Coast is this compressor station of four 660 h.p. packaged integral compressors, built completely on a turnkey contract.

Southwest incorporates engineered, pre-fabricated methods to install unitized facilities — *quicker and cheaper* — for the oil, gas and chemical industries on a turnkey basis. All are API-ASME code constructed.

Southwest's competent staff of mechanical, chemical and civil engineers—all registered as professional engineers with years of experience in this type work—can complete your project months ahead of field-constructed plants. Complete flexibility also enables Southwest to construct to your engineering requirements or to offer custom-designed plants FOB our shops for installation by others.

For the finest in design and operating efficiency, turn to Southwest for your next turnkey operation.

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Also designers, manufacturers and constructors of Packaged Compressors, Inert Gas Generators, CO_2 and H_2S Removal Units, H_2S Recovery Units and "Tenex" Exhaust Gas Injection Units.

It's not what you pay for a bit... it's what the bit does in the hole that determines its value to you!

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